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A New and Mysterious Happiness

A Startling and Sensational Discovery
A Mysterious Secret

NO wonder men and women everywhere are excited over this startling new discovery of a Universal Law and Power by which a new meaning is given to every pleasure, function, action and to every joy, gratification and happiness.

Who could resist becoming excited if the pleasurable realization of life in all of its phases were multiplied and intensified?

You, too, will become excited over this great discovery because it will give you a new thrill—an intense and lasting thrill.

This new and startling discovery of a supreme natural law of life, health and pleasure is joyfully revolutionizing the lives of thousands of men and women all over the world. It is bringing them a new kind of pleasure, happiness, health, strength, confidence, energy and power of personality and success. It is giving them such marvelous energy of mind and body, and they enjoy life so fully, so intensely, so dominatingly, and so thoroughly that the old life to which they were accustomed appears totally inferior in every respect.

The possession of this new and mysterious natural law gives a new idea of how truly vital, alive, joyful, healthy and happy a human being can be—how easily one can be overflowing with life, energy, bubbling vitality and the fire of triumph. Although thoroughly natural and simple, nevertheless it accomplishes seemingly impossible results without sacrifice, active effort or cost.

A new life with a unique thrill is yours when you possess this newly discovered natural law of supreme life, health and pleasure. It is no longer necessary for one to spend money for treatments and drugs and dieting and books and systems and cures and pills and devices, because perfect and supreme health and life are absolutely free through this marvelous natural law.

Why be weak, why be ill, why be fat, why be thin, when you may absolutely free, become in every way perfect and supreme through this sensational natural law?

This extraordinary natural law yields amazing nerve force, amazing energy, amazing vitality and amazing power of every character of mind and body—a new and superior life.

Through this sensational natural law you may have all of the benefits of

exercise without exercise; all of the benefits of conscious deep breathing without conscious deep breathing; the full and complete benefit of every vitamine and organic iron without drugs or dieting; all of the benefits of medicine and drugs without medicine and drugs; all of the benefits of auto-suggestion, hypnotism and psychology without auto-suggestion, hypnotism and psychology; all of the benefits of dieting, and every other kind of treatment, device or assistance without these treatments.

Through this amazing natural law, anyone can rid self permanently of every human weakness; no matter who you are, this Natural Law can demonstrate to you that you do not yet know the full meaning of joy, happiness, pleasure, vitality and gratification.

This Natural Law is ready to give you a new realization of the meaning of life and enjoyment.

This extraordinary and Universal Law does not require you to actively do anything or give up anything. It requires no exercise, no time nor conscious deep breathing—no stretching, dieting, drugs nor medicines.

This natural and supreme law must not be confounded with hypnotism, auto-suggestion, psychology, spiritual science, psychic science, mental science, nor with electricity or any other method—mental or physical—ever devised in the past.

No self-hypnotizing phrases to repeat—no yielding, no recession, no giving up of anything, nothing to study, nothing to actively practice, no books to buy, nothing to memorize, no self-deception—nothing but truth—reality—Natural Law. Perfect health cures every known and conceivable disease. This startling natural law is guaranteed to give perfect health.

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This natural law is most marvelous, most simple, most subtle and most powerful. It is the Law of Creature Power.

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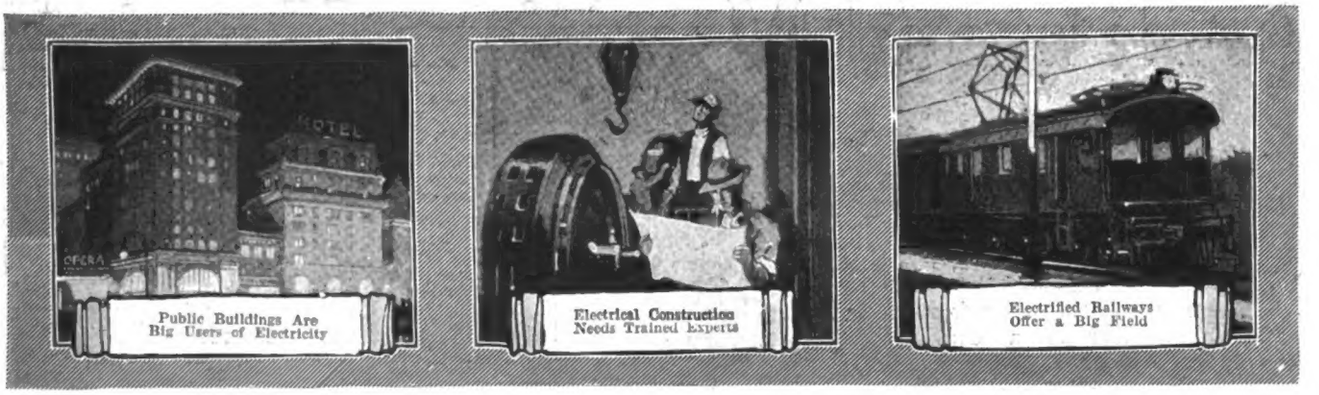
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Electrical Construction Needs Trained Experts
Electrified Railways Offer a Big Field

ELECTRICITY
Electrical Experts Earn

The Men in the Picture

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The "COOK[illegible] Trained Man

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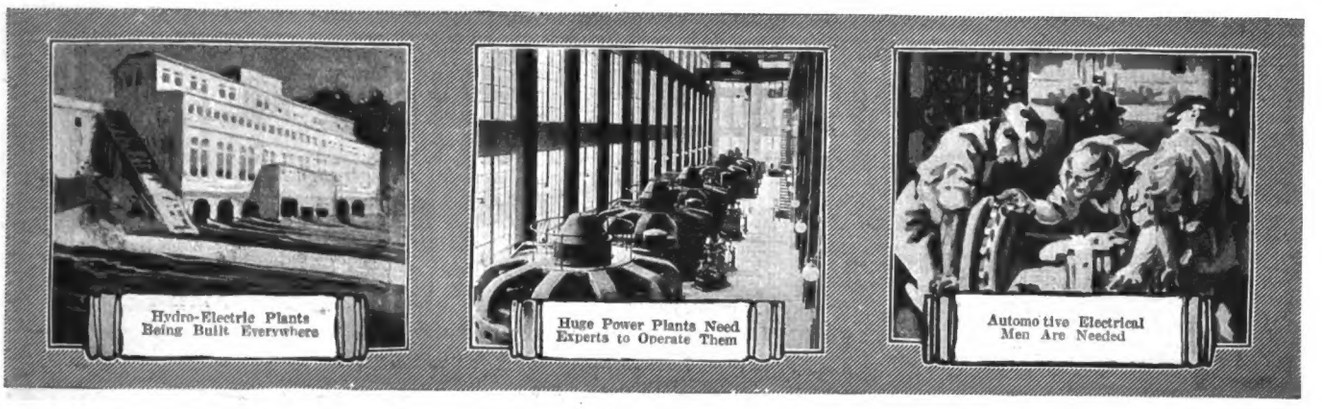
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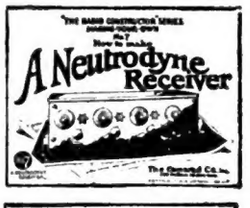

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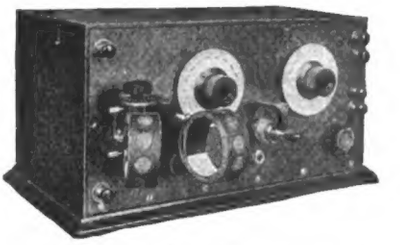

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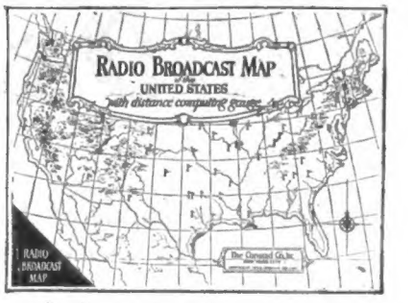

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How to Invent— What to Invent

and What to Do About Protecting and Selling An Invention

ALTHOUGH the fact has been universally recognized that Invention is governed by a few simple, easily acquired, fundamental principles, no one ever thought of putting these principles in black and white so that everybody interested in invention could read them. In spite of the fact that Thomas A. Edison made his famous statement that invention should be taught as a science, thousands of people continued to work blindly, doggedly, haphazardly to perfect their ideas.

But now anyone can learn how to invent. Fifteen famous inventors have at last given to the world the laws and principles of Inventive Science. They have shown every ambitious man and woman how to invent. They are teaching Invention exactly as other people are teaching law, medicine, bookkeeping. Instead of spending years groping blindly, instead of wasting your time in useless, heartbreaking drudgery, you learn how to complete your ideas quickly *and what to do about them* when they are completed. You learn how to think so you are sure to succeed.

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—How to market a patent
and hundreds of other vitally important facts which EVERY successful inventor knows and uses.

Raymond F. Yates, who with fourteen other famous inventors, now makes it easy for you to learn how to invent in your spare time at home.

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For a long time it was commonly believed that every invention was a matter of pure luck—the result of some happy inspiration that suddenly flashed though a man's brain, and which made him fabulously rich without the slightest effort or thought. But you can prove for yourself that this is not so. You can prove for yourself that invention is the result of thinking and action along definitely exact, scientific lines.

Suppose when you went home tonight, you found a window rattling. Through your mind would flash, almost instinctively, a regular order of thoughts which characterize the conception and completion of every invention the world has ever known. First, you would recognize a problem to be solved—the rattling of the window. Then you would think of several principles of science or mechanics which would solve your problem. You might think of the scientific fact that if you poured water on the frame the wood would swell and tighten the window. You might think of using a nail. But what you most probably would do would be to use the oldest mechanical principle known to man, the wedge.

What Invention Is

Brought down to its simplest terms, that is exactly the way every invention has been made—combining two ideas; a problem which must be solved and a fact of mechanics or science which solves the problem. So, although you may never have thought of it in just this way every time you solve a problem in your daily life—at home, traveling, or in business—you are an inventor; you use the principles of thought and action which govern the Science of Invention!

You can see, therefore, how easy it is for you to develop your natural instinct to "fix things." The same processes of thought that almost instinctively told you to fix a rattling window with a wedge can be so well developed that you can learn to invent other things almost as easily and quickly. You know, too, that every invention is made only by thinking inventively. And every inventor is agreed that the principles of Inventive Science are so simple, so easy to learn that any one, regardless of training or education, can develop himself to become a successful inventor!

With every new advance, with every new discovery that the world experiences, more problems are coming up—and more inventions are needed to solve these problems. Now, as never before, are new inventions wanted, and the world will pay a fortune to the man or woman who gives it just one of the inventions it needs.

Even little ideas can bring you a fortune. Eberhard who invented the rubber on the end of a pencil, has been paid hundreds of thousands of dollars for his simple idea. The man who invented the metal tip for shoelaces, the man who conceived the idea of the "humped" hairpin, the man who developed the metal tape measure; all have achieved success and wealth as great or greater than the inventors of large machinery.

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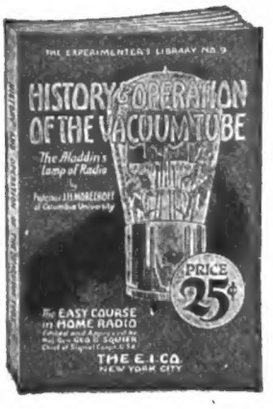
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History and Operation of the Vacuum Tube

By PROF. J. H. MORECROFT
Associate Professor of Electrical Engineering, Columbia University

Edited and Approved by
MAJOR GENERAL GEO. O. SQUIER, Chief of the Signal Corps, U. S. A.

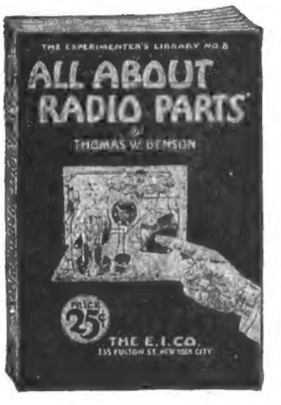
This book serves an interesting study of the fundamental principles, historical evolution, and practical application of the vacuum tube as used in radio apparatus of every description. Since the vacuum tube is one of the most important parts in the modern radio set, and has been largely responsible for making present-day radio entertainment possible, this book has been entirely devoted to the subject of that one particular instrument. It is written in simple everyday language with all technical terms thoroughly explained so as to make matters easily understood by everyone.

The book contains chapters on the phenomena of vacuum tubes in general; the operation of vacuum tubes as detectors and amplifiers; and the junction of the vacuum tube used in various transmitting and receiving circuits, etc., etc.

52 pages printed in legible type; 24 illustrations and diagrams; bound in two-color cover; size 5½ x 7½ inches; **Price, 25c.**

All About Radio Parts

By THOMAS W. BENSON



This book gives an extensive description of the various parts used in all types of receivers, especially explaining the features of certain apparatus and circuits. It also describes why the different parts are used and how they operate. There has been nothing overlooked.

To begin with, the book tells how radio waves are collected by means of an aerial, giving details of construction of different types and their advantages. Then detection is explained and various types of crystal and vacuum tube detectors described. Amplification, including regeneration, radio and audio frequency, is simply told.

This very instructive book will prove to be of great value in the hands of anyone interested in radio as it is very explicit and thorough.

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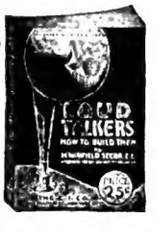

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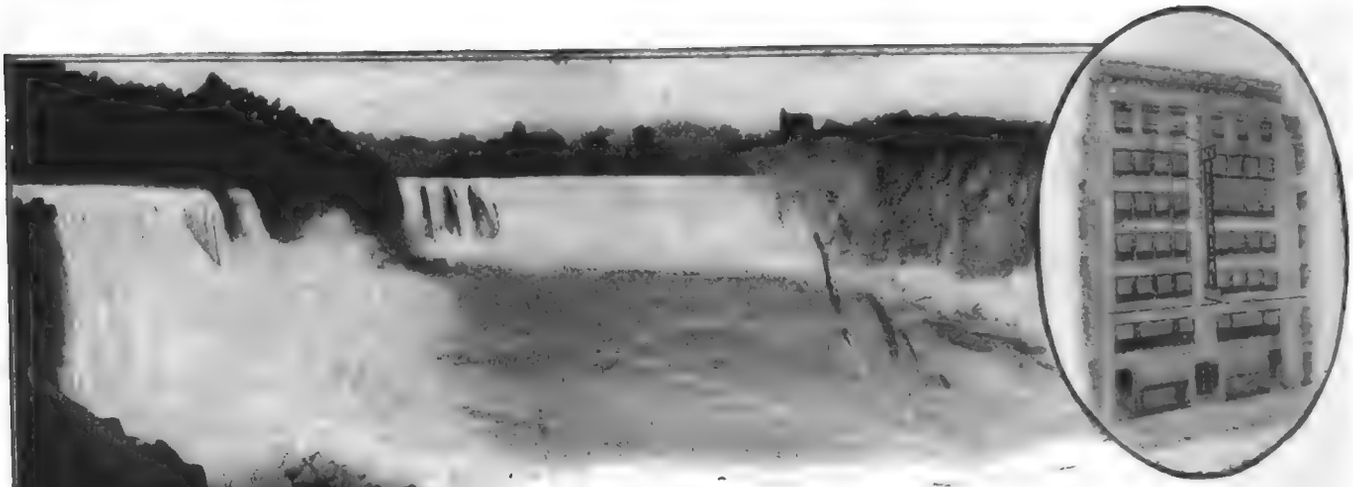

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H. GERNSBACK, EDITOR AND PUBLISHER
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T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" -- HUXLEY

Alice In Sound-Land

By H. GERNSBACK

THE other day I called on Alice—you know, the same Alice whom you accompanied to Wonderland years ago. She had not changed one bit and was as bright and as inquisitive as ever.

I pulled out from my pocket two attachments, like little ear-muffs, made of bright metal and glass and which were to be worn over the ears, not unlike a pair of radio head receivers.

"These," I said to Alice, "are *Sonophones,* a new invention of mine that makes all vibrations in the whole world audible to your ears. As you know the human ear can hear sounds only beginning at about 16 vibrations per second running up to slightly above 32,000 per second. Below 16 vibrations such as certain low basso organ pipes, the average human ear can hear nothing. Above 32,000 such as very high pitched whistles which we can produce in certain radio instruments, the same ear hears nothing further.

I BELIEVE
¶ THAT times have not changed much since Tutankhamen.

"We will now take a trip into sound-land where we will hear sounds of the low and high vibrations."

"This sounds interesting," said Alice, who loves puns.

I clamped the sonophones over Alice's ears and a like pair over my own. A slight adjustment brought us down to sound vibrations as low as two per second. We watched a big eagle over head while he was flying towards us. The note made by his wings was easily audible; not just a flapping noise, but a real low sort of a hum. But as low vibrations did not hold out much interest for us, I made an adjustment to leave the ordinary sound range far behind and adjusted the sonophone for slightly above 30 million vibrations per second. Here electric vibrations reign. Suddenly sounds of jazz music came to our ears. Alice looked at me questioningly.

I BELIEVE
¶ That in order to become an inventor, you must leave the beaten path.

"What you hear now," I explained, "is radio station KSD of St. Louis, broadcasting. The radio frequency vibrations are translated through the sonophone directly to your ears, without aerial or ground connection nor any radio apparatus whatsoever. These vibrations in ordinary everyday life are always about us, only we do not hear them because our ears do not respond to these high vibrations." Alice did not believe me, so she took off the head pieces. Supreme quiet reigned and she heard nothing. Convinced, she put on the ear pieces again and heard station KOP of Detroit, Mich.

We then approached a high power electric line. A slight adjustment brought us in tune with the electric frequencies of this line. A high pitched sound was heard, very pleasing to our ears. But commercial electrical vibrations are slow. So we entered the house and I took Alice near to the big steam radiator in the living room. I set the sonoscope to the *heat vibrations* which go from 70 to 281 trillion vibrations per second. The heat of the radiator gave out a very shrill whistling sound much higher than the electric high tension line and the sounds rose and fell due to the fact that the heat in the radiator was not even. I then adjusted the sonophone for 562 trillion vibrations per second—*light vibrations*—and bade Alice to step out into the sun light. A tremendous roaring sound was heard immediately. We were now hearing light waves, the sunlight giving the vibrations. "Why is the sound not steady?" queried Alice, "for the sun light surely is steady." I explained to her that, due to the sun spots, variations in the strength of the sun light are produced and our atmosphere also changed the light's intensity somewhat. For that reason we hear that peculiar swell such as you hear from a big organ pipe. It was a tremendous sound, great in volume and very pleasing. The sounds were much higher than those of the steam radiator.

I BELIEVE
¶ THAT the more you learn, the less you know.

We next took a jump up to one quintillion vibrations, in figures 1,152,921,504,606,846,976. Alice could not understand that there could be so many vibrations per second. I, however, led her into the laboratory and started an X-Ray tube to work. Here we have the highest and fastest vibrations so far known, *X-Ray* vibrations. The whole room seemed filled with the tremendous high pitch screaming sound that was so high that it became almost unbearable. I next directed the X-Rays upon a sheet of lead. Immediately we heard mixed in with the high screaming sounds tremendous booming noises such as you hear in a naval battle. "Why the loud booming noises?" asked Alice. I hastened to explain that as long as the X-rays were not interfered with we heard the high pitched sounds, but the minute we block the rays by means of lead there are collisions between the rays and the atoms of the lead, causing explosions which were the noises we heard.

"Are there still higher vibrations?" asked Alice. "Yes," I said, "if you go up to the 62nd octave you will have over 4½ quintillion vibrations, but so far we have not been able to produce them."

Just then the telephone rang, awakening me from my pleasant dream. I instinctively felt for the sonophones. They had vanished, and with them the

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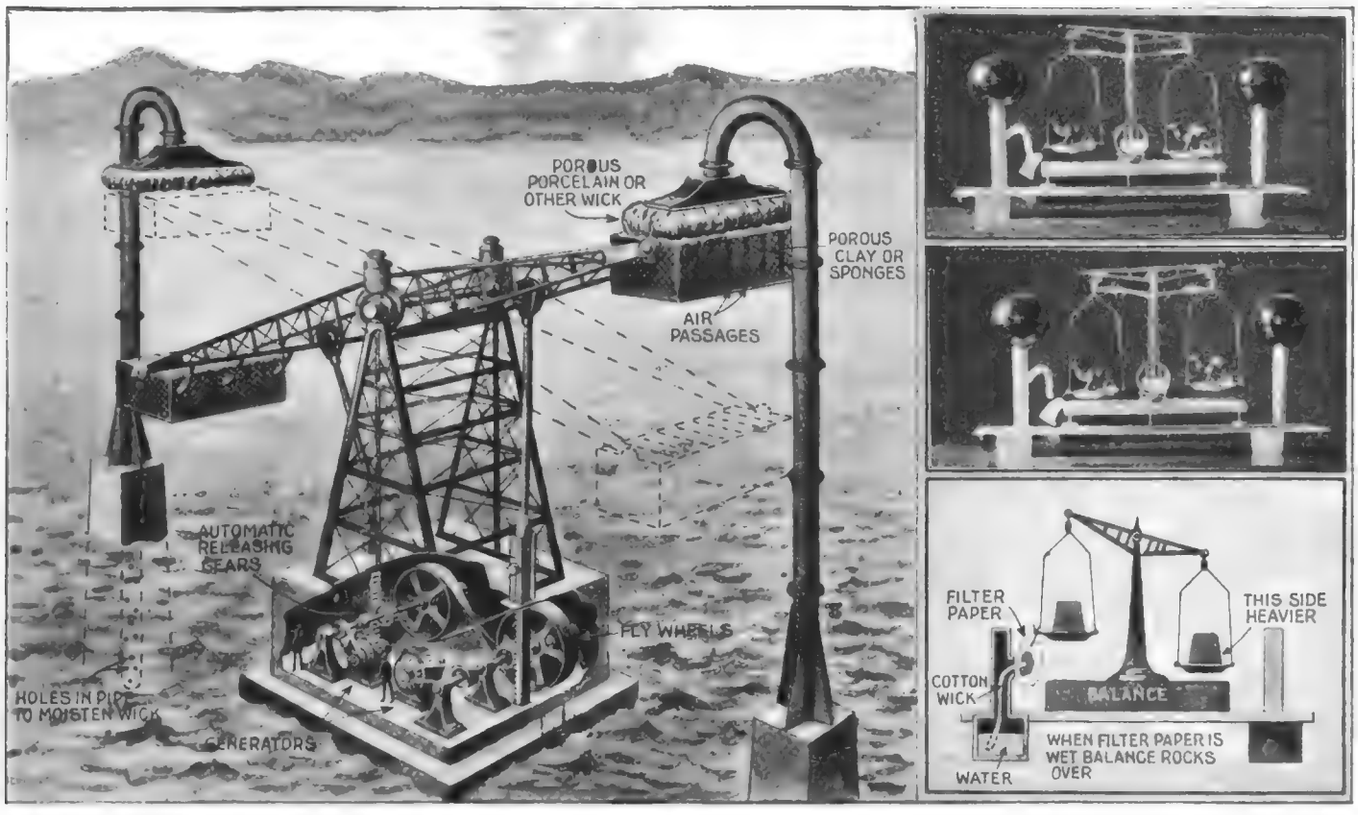
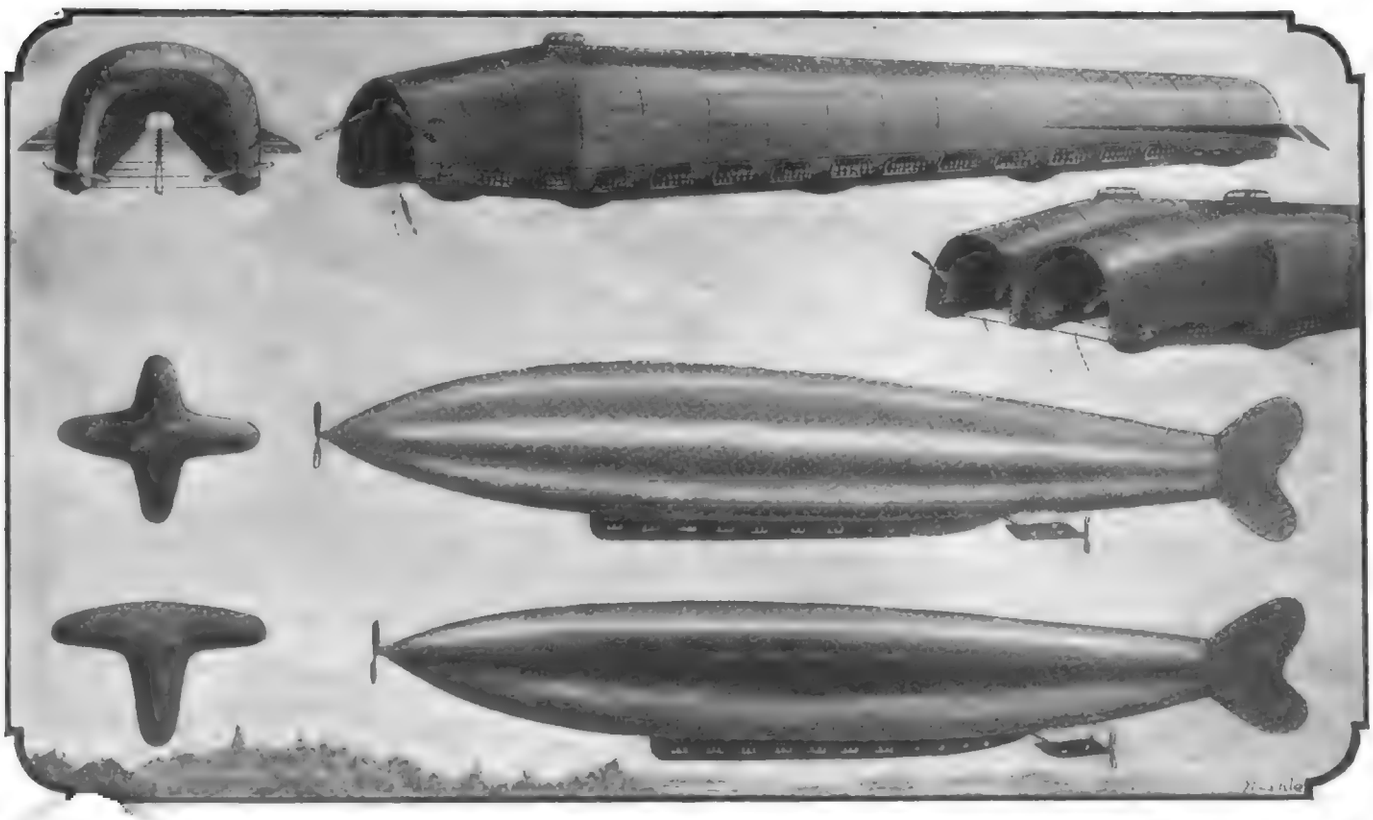
Is This Perpetual Motion?



In the motor shown above advantage is taken of the loss in weight due to natural evaporation. Two receptacles are mounted on opposite ends of an arm and are filled with porous bodies. These absorb water which rises in the stand pipe due to capillary action, and when one side becomes water laden, it swings downward, while the other side rises. It remains in this position until water evaporates from the heavier side and the lighter side absorbs enough water to cause it to over-balance the side now in the down position. The two photographs on the right show a model of the system which actually works. The pendulum rocks back and forth at a rate varying from forty seconds in the summer to one and a half minutes in the winter. Notice in the photos that a small piece of filter paper is attached to one of the beams of the balance. —C. Marshall.

Construction of Super-Airships



...an-air machine is finally adapted to actual freight and passenger ...et, it will probably take one of the three forms shown above since ...nous aeronautical engineers are agreed that these types are the most stable and dependable yet devised. They were designed by Colonel Marcel de Passy, a French engineer. The inverted U-type can lift 205 tons and can make a speed of 130 miles per hour. The X- and T-types provide extreme stability. —Ruth A. Krohn.

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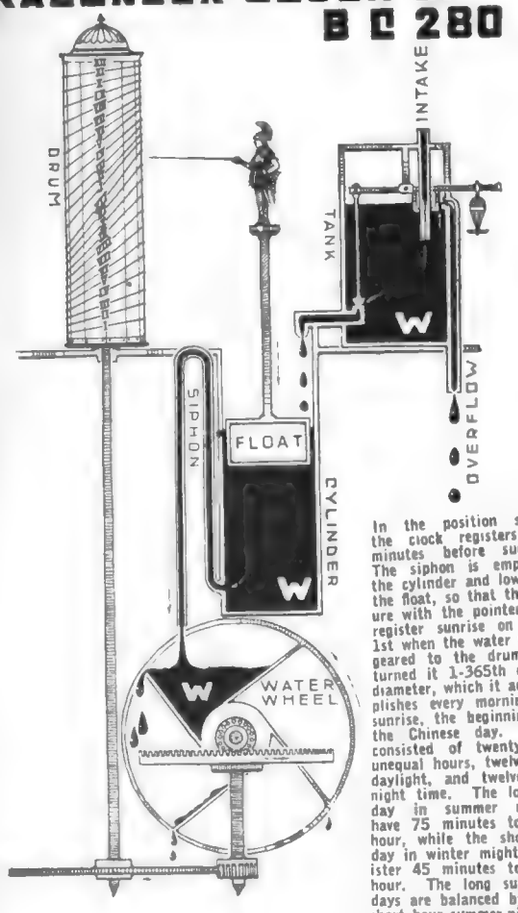
Ancient Clocks

China's Water Clocks Date Twenty Centuries Before Christ

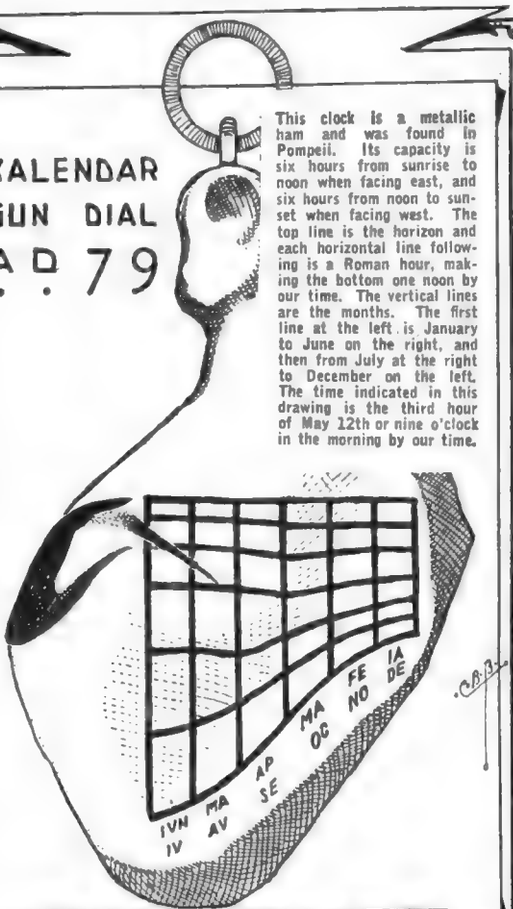
BY CHARLES BEECHER BUNNELL

KALENDER CLOCK OF B C 280



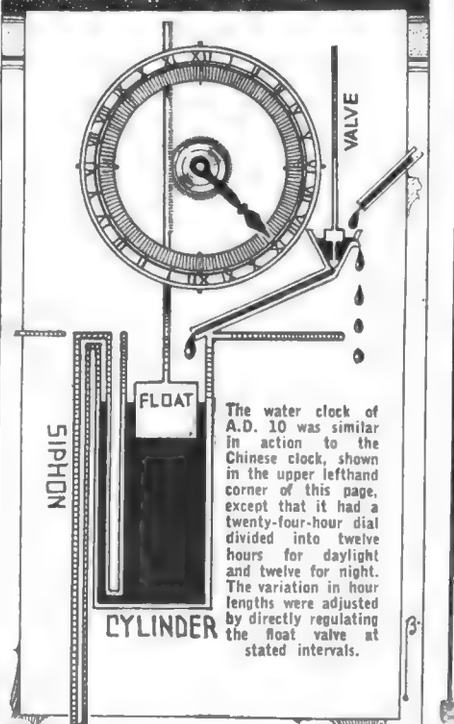
In the position shown the clock registers five minutes before sunrise. The siphon is emptying the cylinder and lowering the float, so that the figure with the pointer will register sunrise on June 1st when the water wheel geared to the drum has turned it 1-365th of its diameter, which it accomplishes every morning at sunrise, the beginning of the Chinese day. This consisted of twenty-four unequal hours, twelve for daylight, and twelve for night time. The longest day in summer might have 75 minutes to the hour, while the shortest day in winter might register 45 minutes to the hour. The long summer days are balanced by the short hour summer nights. Hence the elliptic diagonal rings on the drum.

KALENDAR SUN DIAL A D 79



This clock is a metallic ham and was found in Pompeii. Its capacity is six hours from sunrise to noon when facing east, and six hours from noon to sunset when facing west. The top line is the horizon and each horizontal line following is a Roman hour, making the bottom one noon by our time. The vertical lines are the months. The first line at the left is January to June on the right, and then from July at the right to December on the left. The time indicated in this drawing is the third hour of May 12th or nine o'clock in the morning by our time.

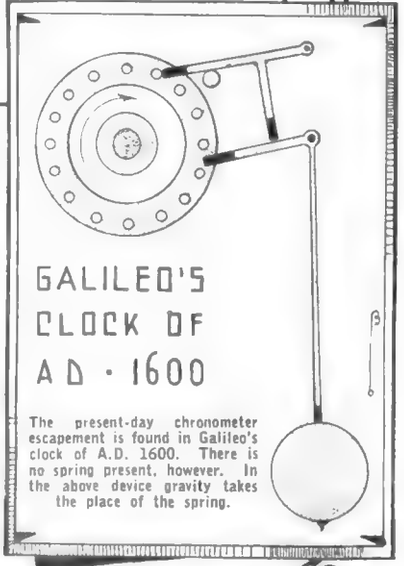
ΚΛΕΨΥΔΡΑ



The water clock of A.D. 10 was similar in action to the Chinese clock, shown in the upper lefthand corner of this page, except that it had a twenty-four-hour dial divided into twelve hours for daylight and twelve for night. The variation in hour lengths were adjusted by directly regulating the float valve at stated intervals.

The clock shown above is of the year A.D. 500—King Arthur's clock in the days of the round table. Notice that the graduations are accelerated because heat thinned the oil and also expanded the imprisoned air. This made a forced feed, which gave a brighter light the longer it burned.

GALILEO'S CLOCK OF A D · 1600



The present-day chronometer escapement is found in Galileo's clock of A.D. 1600. There is no spring present, however. In the above device gravity takes the place of the spring.

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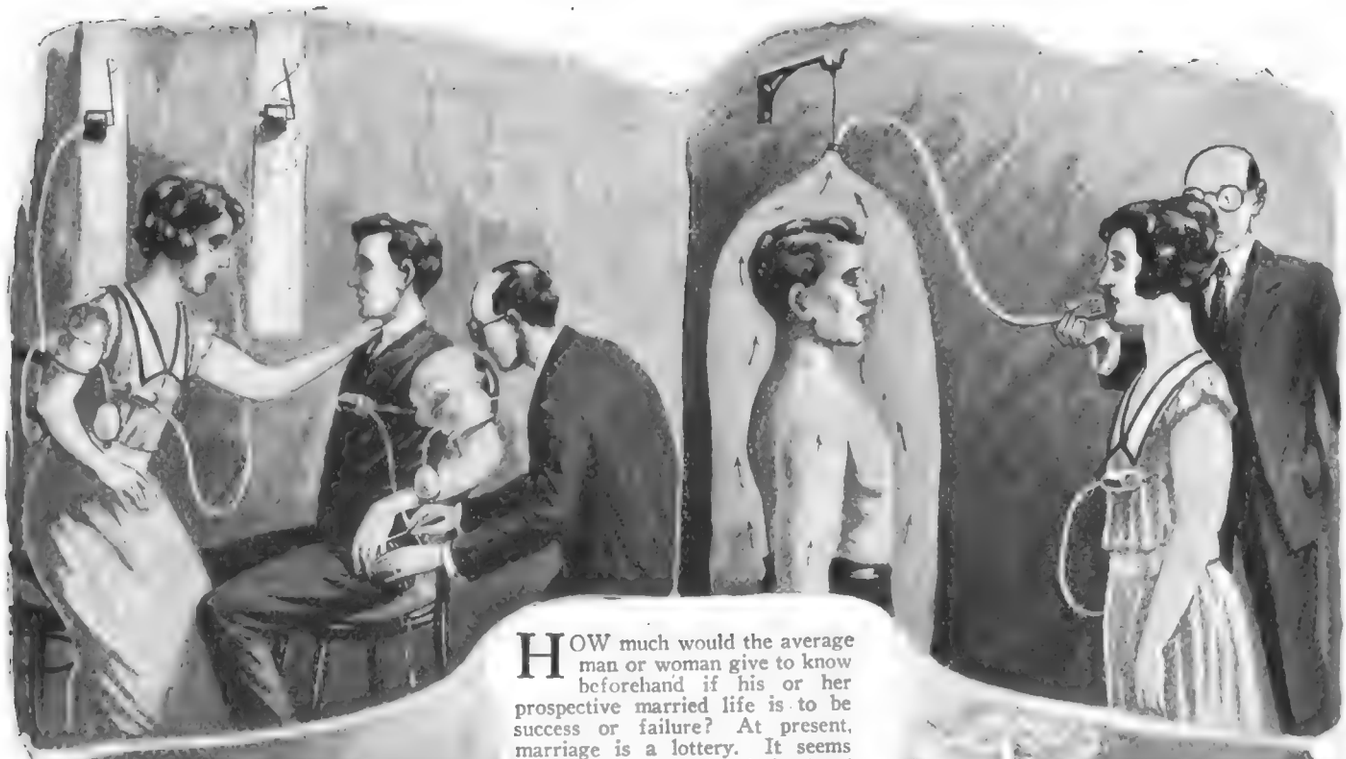
Scientific Mating

Science Shows How To Be Happy Though Married

By H. GERNSBACK
MEMBER, AMERICAN PHYSICAL SOCIETY



HOW much would the average man or woman give to know beforehand if his or her prospective married life is to be success or failure? At present, marriage is a lottery. It seems impossible to predict beforehand how your prospective mate will turn out in the future. Through certain fundamentals, which can easily be ascertained, one can be reasonably certain as to one's choice. We take extreme care in breeding horses, dogs and cats, but when we come to ourselves we are extremely careless and do not use our heads nor the means that science puts in our hands for scientific breeding. There are certain basic tests which can be made today and which will give one a reasonable assurance of married happiness.

Physical attraction ranks first in a successful marriage. In the lower left hand illustration, also on our front cover, we have shown how physical attraction can be checked up for both individuals. Both candidates for marriage are equipped with electrodes at the wrist for operating the electrical sphygmograph which records the pulse beat; around the chest of each is a chain which is secured to a piece of spring covered by a rubber hose. One end of the tube thus formed is sealed, the other connects to a manometer and also to a tambour supplied with a stylus. The stylus leaves a record on a moving paper tape showing the rate of respiration. Around the arm of each party is an inflatable band, the tube of which connects to a tambour leaving a record of muscular contractions.

By means of these instruments, it is possible to check up the emotions of each when embracing or kissing. If the apparatus does not give a certain maximum of one of

(*Continued on page* 1269)

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The Man On the Meteor

PART FOUR OF A SERIES

By RAY CUMMINGS

SYNOPSIS OF "MAN ON THE METEOR"

WITH no memory of past events, a young man suddenly comes to his senses on a meteor which is part of one of the rings of Saturn. Being hungry and thirsty, he looks around for nourishment and finds the mouth of a cave. As he looks towards the cave a girl comes into view.

The young man, who calls himself Nemo, enters the cave and after traversing some little distance finds it to be illuminated by the phosphorescence of the rocks forming its walls.

The problem of finding sufficient food became paramount in the life of Nona and Nemo. One day upon returning to the cave Nona shows Nemo several mollusks which make good food. She then takes him to the place where she found them to gather more. They wade into the stream and follow it into its cavern. Nemo sees that Nona's head is completely engulfed. Soon his head goes under water and he feels the liquid rush into his lungs. However, by violent effort he is able to breathe. He finds that the water, being so highly aerated, readily supplies his blood with the necessary oxygen to sustain life. They come to a bed of shell-fish, collect enough for their needs and go back to their home in the cave. They start a fire, cook their supper and retire.

In the middle of the night they awake to find their entire cavern in flames. The rock, being of a combustible nature, has become ignited from the cooking fire. They dash toward the mouth of the cave and out to the surface of the meteor. Thus robbed of their home they "swim" through the air to the opposite side of the planet. Here they make their home beside a large stream at a point where it enters a low hill. Soon smoke and fumes from the conflagration drift over to their side of the small meteor. Nemo is suddenly seized with an idea and taking Nona with him he plunges into the water and follows the bed of the stream into the mountain. Soon they find food and devour it, still under water.

At this point they see coming toward them a party of ten people, four men and six women, who are somewhat human in form, but have four arms like the tentacles of an octopus. Nemo and Nona are captured and tied by them. A large vehicle is seen coming along the bed of the stream and the Marinoids, as Nemo calls his capturers, prostrate themselves. Nemo does not follow suit and the occupant of the vehicle throws a spear at him. He is struck and falls senseless.

When Nemo comes to his senses, he and Nona are taken by the Marinoids to the city called Rax. This city is under water and, unlike the cities of our earth, is built of underwater vegetation.

After Nemo and Nona have lived with the Marinoids for some few months, Nemo becomes practically indispensable to the ruler or King of the city and is consulted by him on various occasions. The couple lived in the same home with one of the Marinoids, but after their child was born, whom they named Boy, they were given a home of their own. Soon after this a man named Og insulted Nemo and challenged him to a fight. The fight took place in front of the palace of the ruler and Nemo was defeated because Og had a peculiar property, which was characteristic of the Marinoids, enabling him to send a charge of animal electricity into the body of Nemo, thereby rendering him unconscious. After the fight, Nemo is brought back to consciousness by Nona. He finds, at a later date, that the electricity used was similar to that found in the body of the electric eel, common on the earth. After recovering fully, Nemo starts to look for his recent adversary, but is unable to find him, and he soon learns that Og has left the city.

The thing went past us—quietly, without seeming to notice us. It was a ribbon-like thing thirty feet long, two feet high, and no more than a few inches thick. A pallid white ribbon of puffy slime, frayed and tattered at its edges, it undulated gruesomely from end to end.

On the platform also, between Og and the white old men, my Nona was sitting with her arms bound at her sides! My Nona, beautiful as always, pink skin, blue eyes and golden hair—so vivid amid that pallid, ghastly throng! And she was unharmed—with spirit unbroken—I could see that by the flash of her eyes, her scornful, unwavering gaze as she leveled it at the puffy white faces staring up at her.

I GO back again in my memories to that year in the underwater Marinoid city of Rax—the year of quiet and peace for Nona and me which followed the birth of our son. Boy, we called him; everyone called him that, for he was the only child of his kind in our world.

It was a wonderful, happy time for us both. In all the Universe there was never another like our Boy. So thought Nona and I. Pink and white, with his laughing blue eyes, and soft blond hair on his little head, he would lie cradled in the big white shell that stood in the center of our living room. The tiny bits of vegetation which often floated in the water past his face were his toys to snatch at and demolish; and Nona, who fed him, crooned to him, and when he was no more than a month or two old guided his baby flounderings into swimming strokes, was the center of everything around which his infant world revolved.

For myself, almost an outsider with these two, it was enough to watch them playing

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together, to see the light of motherhood in my Nona's eyes, and the glory of it on her face.

The time—unmarked by daylight or darkness down here in the water—glided by; and for us the passing days meant only that Boy was growing larger, his limbs were lengthening, his neck would now support his head, he could swim and soon he would begin to talk.

Caan and I whirled downward, shouting. Through the window of a house, we saw the stiffened body of a woman come floating. There was light enough for us to see her white face and arms—a woman unconscious, shocked into insensibility as we later learned, by a bolt of animal electricity from her abductor.

Thus can happiness exclude one from the world around. Yet it must not be inferred that we lived at home in complete seclusion. There were happy times with our friend Caan and his family—in his home when Boy would lie there asleep and we others would play at a game of floating shells.

And there were other times when I went hunting with the Prince. He seemed to like me—and his friendship I must confess, was to me a great joy and pride. Like many another Prince of your own Earth, Prince Atar was a sportsman. Occasionally, heading a little party of his friends, he and I would hunt together, swimming off toward the Water of Wild Things, where, over the cliffs which bordered the Marinoid domain, strange fearsome creatures would sometimes trespass.

CITY'S WORK

My means of livelihood? Oh yes, I was a worker like the rest. There was no place in Rax for a drone; and Nona and I were by no means guests of the city—no longer than the first month or two. When they gave us our home I was assigned to work with Caan. After each Time of Sleep, we swam out with our baskets into the open spaces beyond the forest which surrounded the city. We would gather up the shell-food that lay on the sea-bottom. It was continually sifting down from above, and what we collected was later gathered and driven in to Rax, to the government store-houses.

Caan's wife worked with us—for women, even though married, were obliged to work for the public good a portion of the time. After Boy was born Nona, too, often joined us—though this was not obligatory, for the care of infant children discharged a woman of the debt of working otherwise.

There is so much that my memory holds to tell you of this strange Marinoid civilization! But you, with your life to live at high speed, would weary of me if I were not careful. You want everything at a glance—and you shall have it.

Let me say then that during this peaceful year there were occurring in Rax a series of mysterious incidents of an exceedingly sinister character—incidents which shortly were to lead us into the most stirring and critical period of Marinoid history. But we did not know this at the time. Life—wherever in the Universe it may be found—runs on a similar plan. It's like a puzzle—a jig-saw puzzle whose picture remains undefined until you fit the last segment into place.

So it was with these ominous events that now occurred one by one in Rax. (And the absent Og, I may say, was at the bottom of them.) Each in itself seemed relatively unimportant. Yet all were part of a plan of destruction that was menacing us like an unseen sword hung suspended. We awoke to a realization of the danger, finally. You shall hear how it was I, who—when the thing at last struck home as a personal tragedy to me—played a leading part in the stirring scenes that followed.

May I ask you first to bear with me a moment more, while I give you a very brief summary of conditions in our Marinoid world? I know you will chafe. A thousand supposedly pressing duties of your own super-civilized life are forcing themselves upon you even at this moment of relaxation. Set them aside, I beg you. They are not nearly so important as you think. If you were to die tonight, leaving all of them undone—your world would go on as placidly as before.

A moment then—and you shall have action and movement to your heart's content.

II

The region of the Marinoids was a stretch of water bounded by great rocky cliffs on all sides. It was subterranean water—by which I mean that ascending in it one came at last to a rocky ceiling. We were, at Rax, near the center of this subterranean sea. What was its extent, I cannot say. All measurements, all standards of comparison, were lost to me. In depth—at Rax—it might have been two thousand feet or more from the sea-floor to the ceiling above, which is to say some two or three times the depth of the city itself.

How many entrances there were from the outside world, I do not know. Through one of them Nona and I had come when Caan and his party first encountered us. To the Marinoids, who were not explorers, the idea of a *surface* to water was inexplicable. They could not conceive of such a thing; they could not understand it when I tried to explain it to them.

There were several Marinoid cities besides Rax, but none nearly so large. And there was—shall I say a rural?—population. In the great forests, Marinoid dwellings were occasionally to be found—isolated huts of sea-weed, clinging like bird-nests to the wavering branches of the trees. And in the open water other scattered families of the more adventurous turn, lived in huge shells from which they had excavated the living tissue—or lived in holes hollowed out of the banks of black ooze.

The boundaries of the Marinoid domain presented themselves as almost perpendicular cliffs—dark, jagged rock, with slabs and banks of black clay, mounds of coral, red, black and white, or a tangle of slimy vegetation. Openings which were caves—a cliff-face honeycombed with them. And the ceiling was of similar character.

One of the boundaries—the one nearly opposite to where Nona and I had entered this world—was somewhat different. Here the cliff-face rose to over three thousand feet. But here also, the ceiling was even higher, so that between them there was left an opening a hundred feet or more in height, and a mile, at least, in horizontal width. It was a fearsome opening. Its floor seemed to extend backward and downward. The water in there was black; a thick slimy ooze was under it. And there seemed to be in it the suggestion of a noisome stench that lay beyond.

This was the entrance to another region, of unknown extent—the Water of Wild Things as the Marinoids called it. What might lie in there, none could say. A few had penetrated into it a short distance, and returned with lurid tales which none believed. And others had gone and never come back.

But that there were half-savage humans living there, everyone believed. Og was bred of them, some said; and now that he had voluntarily gone there to live, as rumor had it, so much seemed a certainty.

Strange animals occasionally came from the Water of Wild Things. A sea-monster had come once. But that was in the dim past, remembered only by legend. The monster had all but overcome the cloud of Marinoids who had desperately set upon it.

Such were the conditions under which we, at Rax, were living.

And now I am ready to tell you of that series of incidents which awakened us to our danger. They did not at first concern me personally, and so I paid them little heed. That is a commentary upon your own life, is it not? Soon the thing struck home to me with its tragedy. Ah, then how different it seemed! We can bear the grief of our friend so much more philosophically than our own!

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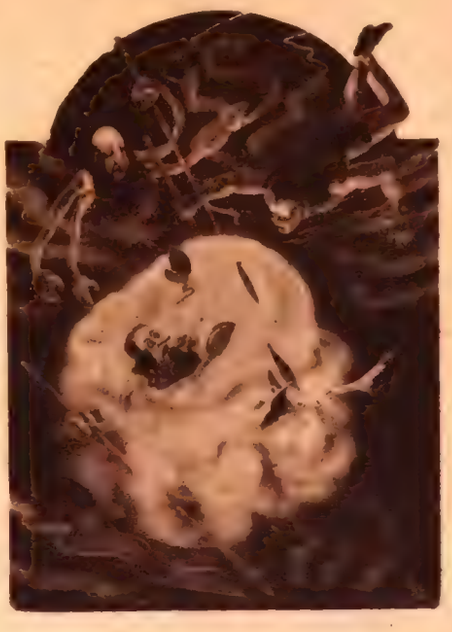

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

Doctor Hackensaw had started a Brobdingnagian farm. Trees but a few years old were there, yet they towered higher than the gigantic California redwood trees. Giant animals and plants of many varieties were present.

No. 28--The Secret of Size

(Author's Note.—What causes size? Why, in a normal family, will a dwarf occasionally be born; while, in another normal family, a giant will suddenly appear? What causes these exceptions? Every abnormal growth, every monstrosity, has its reason for being, and the function of science is to discover these causes. Once known, we may prevent these growths, or, if we so desire, we may produce giants and dwarfs at will.)

"HERE I am again, doctor," cried Silas Rockett gaily entering the laboratory. "My newspaper, 'The New York Daily Growl,' wants some particulars in regard to your giant rabbits."

"What particulars do you want?"

"In the first place, is it true that you have live rabbits the size of an ox?"

"Yes, it's perfectly true."

"Next, my editor wants to know how you produced these creatures."

"Ah, Silas; it was no easy job, simple as the matter really is. But I got started on the wrong track. For years I have been seeking to discover why it is that an occasional giant or dwarf is born, but it was only after long research that I discovered the 'Secret of Size.' Still I finally solved the problems, and I have some specimens of my work at my country-place in New Jersey that I am sure will interest you."

"The 'Secret of Size'?" echoed Silas. "What is the Secret?"

Doctor Hackensaw smiled. "That's a thing that has puzzled many a scientist, and all kinds of theories have been advanced to account for abnormally large or small growths. Still, in general, scientific men be- the cause of the occasional production and dwarfs to lie in metabolism. der it the effect of anabolism and "

"Wh— wh— what?"

"Metabolism. To speak more simply, they consider the question one of nutrition or food. Anabolism is the building up of tissue, and catabolism is its destruction. If an animal or plant gets a great deal of food, and can assimilate it, it grows to giant size. On the other hand, if it is starved, it remains small,—it is dwarfed."

"Nonsense!" cried Silas Rockett. "Do you mean to tell me that if I fed a baby rabbit and a baby elephant the same amount of grass, the rabbit would grow to the size of the elephant?"

A QUESTION OF ASSIMILATION

"Yes, if it could properly assimilate the food. Otherwise you would merely kill it. The theory of metabolism is the true one, but I did not find it of much assistance. True, we see examples of it every day. The weeds around a manure-heap, for instance, grow taller and ranker than normal;—in fact I have seen such plants grow to three or four times the usual size. A man three or four times the normal size would be a giant eighteen to twenty-four feet high. In the case mentioned, the *amount of food* seems of itself to be sufficient to produce the excess of growth. On the other hand, there are also well-authenticated cases with regard to dwarfed plants. The Japanese, for instance, achieve considerable success in producing dwarfed trees. They produce dwarf apple-trees about one foot high, perfectly formed in every respect, and bearing real apples! These miniature trees are produced, I am told, by giving the young plant barely food and moisture enough to keep it alive. It thus grows for years and years, and yet remains diminutive in size."

"How about alcohol? I thought animals were stunted by giving them alcohol?"

"Yes, the case is somewhat similar. Formerly it was a common practice to keep pet dogs small by administering suitable doses of alcohol. This seemed to check the proper assimilation of food and therefore the growth of tissue. Certain scientists have claimed that the pineal gland in the brain, determined the size of the animal, but this theory may be disregarded. Very little is known about the pineal gland, so that it makes a very convenient nucleus to hang any theory on; and all sorts of powers have been attributed to it."

Here Doctor Hackensaw paused for a moment, and then continued: "I had not carried on my experiments long before I became convinced that the question of size was one of nutrition; and yet not quite in the way ordinarily imagined. An experiment I made with dogs led me to view the matter in the proper light. You have probably seen the pet dogs the ladies are so fond of,—the Toy Pomeranians, small enough to be cuddled in one hand. Well, it struck me that, here among dogs, where we have giants like Great Danes and St. Bernards and dwarfs like the Pomeranian, there was a fruitful field for research-work. I accordingly took a fertilized ovum of a Toy Pomeranian, and one of a Collie, and introduced both of these into the womb of an ordinary-sized dog. When she gave birth to the puppies, there were, as I had anticipated, a Pomeranian and a Collie. The former remained small—the latter grew to normal size. Both had received the same nourishment in the mother—evidently the difference extended further back—it extended as far back as the fertilized egg.

"Here, on the very verge of success, I was non-plussed, and I got off on the wrong track. 'If,' thought I, 'I could change every one of an animal's cells to double or triple their normal size—the animal itself should be two or three times its regular size. And if, on the other hand, I could reduce the size of each cell, the animal itself would be dwarfed.' The theory was very plausible, but it led me nowhere. All my experiments in this direction failed.

"These are my pets!" said he. "These are giant bacteria and bacilli. I have here the disease-germs of cholera, malaria, yellow-fever and of many other illnesses. By growing them to this gigantic size, I can study them much better than I could through a microscope, and learn their life history and the effects of remedial agencies."

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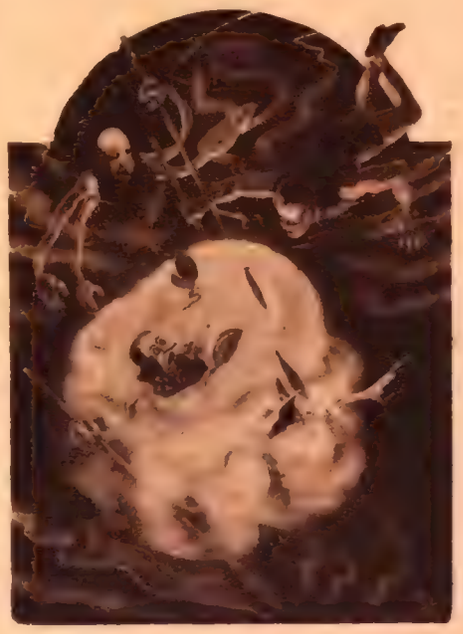

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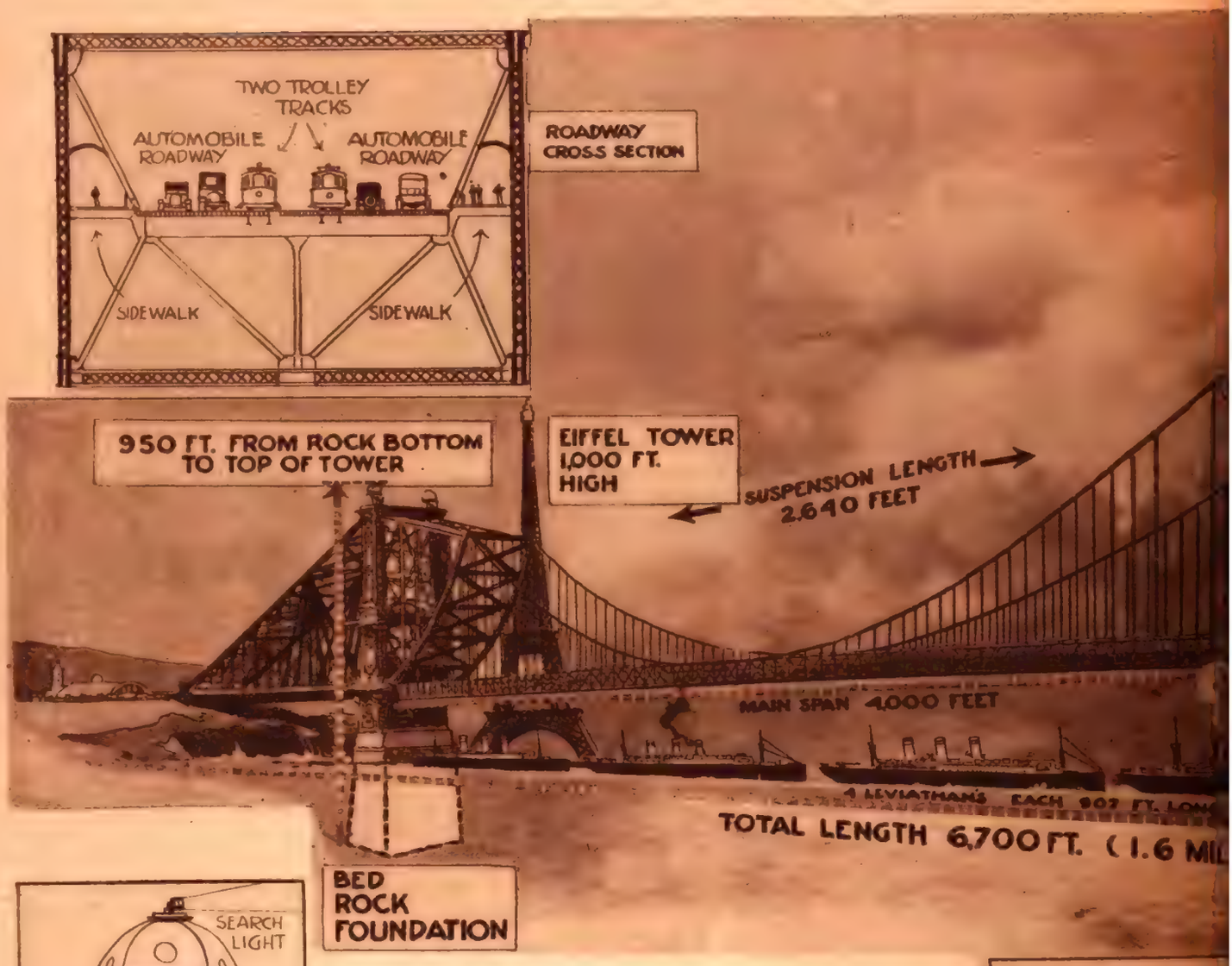
World's Greatest Bridge

Monster Span Will Incorporate Cantilever and Suspension



OBSERVATION TOWER SHOWING ELEVATOR

WHAT will be the biggest bridge in both length of span and height of suspension in the world, if it is constructed, will be the contemplated Golden Gate bridge between San Francisco, Cal., and the opposite northern peninsula. The total length of the central span of the bridge from shore to shore will be 6700 feet. At 1345 feet from the shore on each side the water is more than 300 feet deep. This makes the total length of the central span of the bridge 4000 feet. In order to effectively support a carrying structure across this great space it will be necessary to use both the cantilever method and the suspension method. From the towers which are 777 feet above the water level, the cantilever construction will extend back to the approach and over the water. The cantilever arms will extend 660 feet out into the main span and from the end of these arms suspension cables will be used. The towers upon which the bridge will be suspended, will have a total height of more than 950 feet, making them almost as tall as the Eiffel Tower. The design shown here was worked out by J. B. Strauss, an eminent bridge engineer, who is president of a Chicago bridge company. The reason for the combination of the two systems of suspension, according to Mr. Strauss is that the cantilever type demands too heavy construction for such a long span, incurring an extraordinarily heavy frame in order to support the weight of the bridge itself, aside from the demands made by the weight which the bridge is to carry. On the other hand, suspension cannot be used alone since the length would give the bridge a great lack of rigidity—which rigidity is essential in constructing spans the length of the one contemplated. The two main cables which would be necessary to support the bridge would be one mile in total length and would weigh approximately 5,250 tons. Their cost would closely approximate two and [illegible] half million dollars. The width of the roadway space would be [illegible] eighty feet; there would be one single deck only. The suspension span would be 750 feet longer than the proposed Hudson River bridge. One of the chief problems confronting Mr. Strauss in the design of this bridge was the fact of the existence of very high winds at the point where the bridge is to be constructed. The added strain placed on the structure by this element had necessarily to be considered at every point.

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"At this juncture I chanced to read the result of some of the experiments made by Dr. Driesch on fish's eggs, and by Jacques Loeb on the eggs of the sea-urchin. Dr. Driesch cut a fish's egg in two, and succeeded in growing a complete fish from each half-egg:—one egg thus producing two fish!

"That four-year-old baby giant you see over there, is looking at his twin brother—a four-year-old dwarf held in the palm of its nurse's hand. Yet both were grown from the same egg. Quite a contrast between the two, isn't there—the first child fifteen feet high and his twin brother about five inches in height!" said Dr. Hackensaw.

Jacques Loeb carried the experiment a step further. He took a sea-urchin's egg, raised it until it had reached the sixteen-cell stage, and then cut it into sixteen pieces. He raised each of these cells separately, and thus succeeded in raising sixteen sea-urchins from a single egg that would normally have produced only one animal! But (and here was the ray that threw light on my problem), the sea-urchins, when mature, were smaller than the normal size. They had not had enough capital to start with, and had remained dwarfs. Size is evidently a question of nutrition, but the problem has to be referred back to the egg stage.

DWARFS ALSO

"Science has also succeeded in doing the very reverse. Experimenters have taken two separate eggs, joined them together into one, and hatched a single individual out of this double egg. And this individual, as might have been expected, was larger than the normal. Ample capital at the start had given it an advantage in the race for life. My problem was solved!"

"You mean to say that you can produce dwarf or giant animals and plants at will?"

"Precisely. To produce a miniature St. Bernard dog for instance, I take a fertilized egg-cell from an ordinary female dog of the species. I grow this ovum in a test tube in a suitable culture-fluid, and keep separating the new cells as they form. In this manner I can, from a single egg-cell, produce a hundred or more dwarf dogs. If I want a giant dog, I reverse the process. I take a number of fertilized egg-cells, join them all into one single large cell, and grow this to maturity."

"Is it as simple as all that?"

"Simple! It is exceedingly complex, and many curious problems are involved! For example, I can produce a dozen *giant* dogs from a single egg. I grow this egg to the sixteen-cell stage, then unite these sixteen cells into one large cell and grow this to the sixteen cell stage and so continue indefinitely. This I find most useful when breeding thoroughbred stock. From a single egg from the most perfect animals I can produce a hundred young the same size as the parents, or larger or smaller if desired. I can also produce freak animals. I can join an egg-cell that would ordinarily produce a male, with a cell that would produce a female, and thus combine the two different cells into a single egg. Again, this method enables me to make marvelous crosses and produce hybrids impossible in nature. I can join the egg-cell of an elephant with that of a mouse, and get a freak animal any size I desire. I can combine a dozen different animals together in this way—in fact I have hybrids of the whale, the rhinoceros, the dog, the cat, the ostrich and the salmon, all joined together into a single animal. It makes the most wonderful combination.

"But to return to the subject in hand, I would say that I have completely mastered the question of size. I am now able to produce chickens as large as ostriches, pigs as large as a rhinoceros, and cows as large as some of the extinct antidiluvian monsters. There is no danger now of our supply ever running short. A ham will last a family for a month, a hen's egg will feed a dinner-party, while one cow will give enough milk to supply a dairy."

"How do you milk your giant cows?" asked the reporter.

SOME PROBLEMS

Doctor Hackensaw smiled reminiscently. "That, Silas, was no easy problem," said he. "My hired help were all afraid to go near the huge creatures that could crush them to a pulp by inadvertently stepping upon them, and whose twenty-four foot long tail could swish them over like nine-pins. Just think of having to milk a brontosaurus twice a day! Ordinary methods of milking would, of course, be impossible. I have to use a milking machine somewhat like that used in large dairies. I had even to devise special stalls for the beasts, so my men could attend to them without danger from either horns, hoofs or tail."

"What about your other giant productions?"

"My gigantic products are especially useful for furnishing a plentiful supply of tid-bits. For instance, my quail are so large that a single individual will supply quail-on-toast sufficient for a banquet. My frog-legs weigh several pounds apiece. The liver from a single goose will make 1728 times as much *pâté-de-foie gras* as that of an ordinary goose. And so on."

"1728!" echoed Silas. "Isn't that pretty close figuring?"

"Yes; but you see, I find it convenient, as a rule, to make my products on the scale of a foot to the inch. Consequently an animal is twelve times the usual length, and its cubical dimensions and weight are 1728 times the normal ones. For my insects I increased this proportion considerably, as I wished large specimens for the purpose of study. A giant fly, a giant mosquito, and a giant spider afforded me much valuable information. Unfortunately the spider got away one day and found its way into an old maid's meeting. They called themselves the 'Click-Clack' Society, on account of the busyness of their knitting needles; but would be nits dubbed them the 'Clack-Clack' Society, or even the 'Cluck-Cluck' Society, claiming their tongues wagged faster than their needles.

"Well, my giant spider got in among those elderly spinsters and broke up the meeting. Reliable eye-witnesses declare that the display of hosiery and lingerie on that occasion was more wonderful than any ever before seen in the town.

"As for my earth-worms;—well my chauffeur, Pat, came across a bunch of these wriggly giants one day, and declared he had never seen anything like it—at least not since prohibition came into effect."

GIANT PLANTS

"How about your giant plants?" asked Silas.

"The plants gave me considerable trouble. The seeds had the bad habit of getting scattered around, and as they grew into giant plants, this naturally gave the farmer considerable trouble. My most valuable results were obtained with wheat. In this instance I exceeded my twelve to one limit, for my grains of wheat are about the size of musk-melons. A single grain will furnish a good sized family bread for several days. My giant fruits, too, are remarkably handy for the kitchen. My huckleberries and currants are the size of small melons, which makes it easy to extract the pits. My cherries are as large as pumpkins:—it doesn't take long to pick them, but you've got to be careful; as one of them, falling on your head, would make you see more stars than are shown by an ordinary telescope. All in all, my fruits are a wonderful success, and you must taste some of them. I meant to start canning them, but have too many demands for the natural fruit.

"You mustn't believe, however, that I was satisfied with merely increasing the size of our ordinary articles of food. I wanted to go further. I wanted to experiment with those animals and plants which are now too small to be of any use to man, yet which might prove valuable if increased in size. But why am I chattering away here? Just

(*Continued on Page* 1283)

The day following the "New York Daily Growl" appeared with this glaring headline: "Escape of Doctor Hackensaw's Gigantic Animals. Cow, the Size of a Brontosaurus Running Wild in Harlem!"

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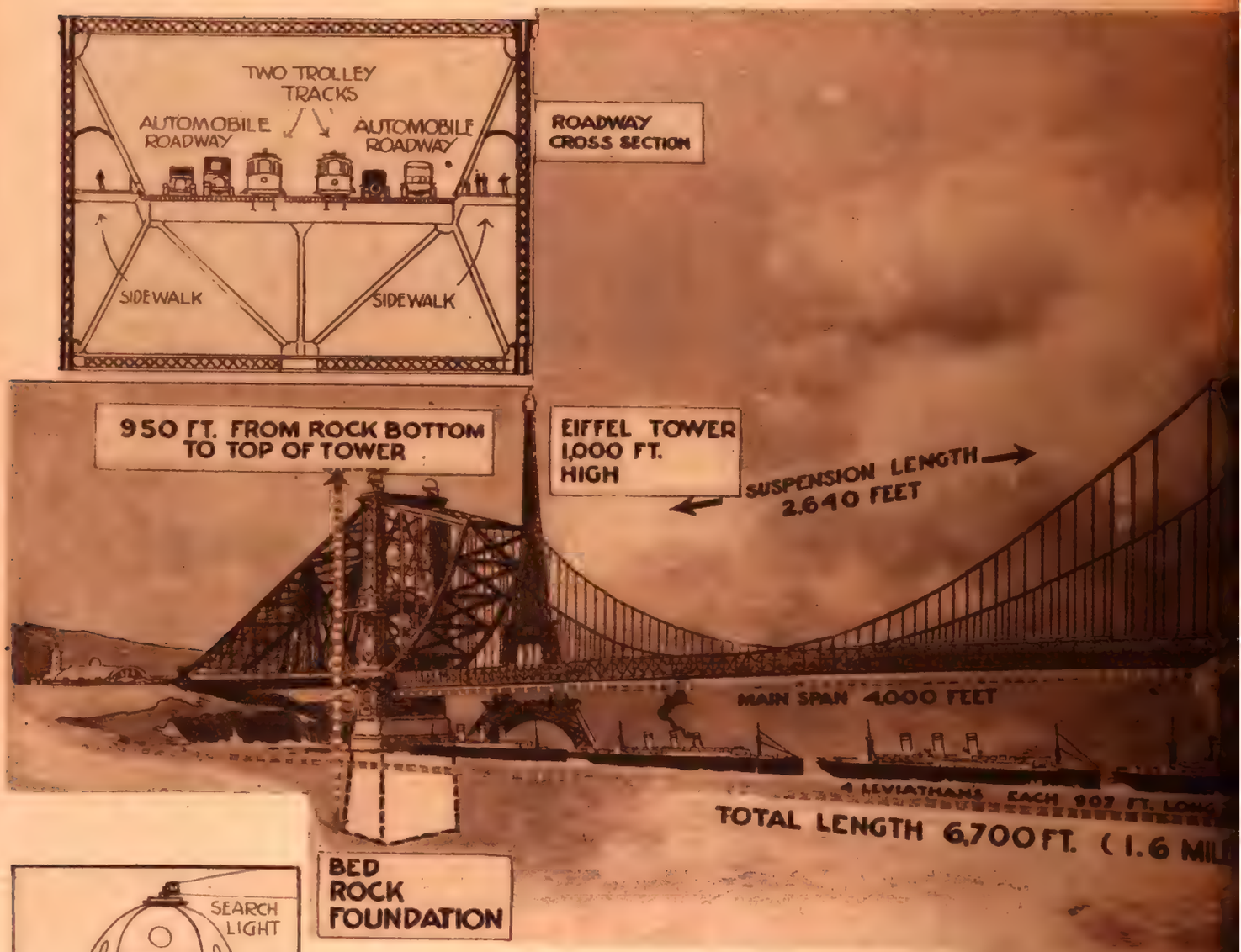
Original from UNIVERSITY OF CHICAGO

World's Greatest Bridge

Monster Span Will Incorporate Cantilever and Suspension



OBSERVATION TOWER SHOWING ELEVATOR

WHAT will be the biggest bridge in both length of span and height of suspension in the world, if it is constructed, will be the contemplated Golden Gate bridge between San Francisco, Cal., and the opposite northern peninsula. The total length of the central span of the bridge from shore to shore will be 6700 feet. At 1345 feet from the shore on each side the water is more than 300 feet deep. This makes the total length of the central span of the bridge 4000 feet. In order to effectively support a carrying structure across this great space it will be necessary to use both the cantilever method and the suspension method. From the towers which are 777 feet above the water level, the cantilever construction will extend back to the approach and over the water. The cantilever arms will extend 660 feet out into the main span and from the end of these arms suspension cables will be used. The towers upon which the bridge will be suspended, will have a total height of more than 950 feet, making them almost as tall as the Eiffel Tower. The design shown here was worked out by J. B. Strauss, an eminent bridge engineer, who is president of a Chicago bridge company. The reason for the combination of the two systems of suspension, according to Mr. Strauss is that the cantilever type demands too heavy construction for such a long span, incurring an extraordinarily heavy frame in order to support the weight of the bridge itself, aside from the demands made by the weight which the bridge is to carry. On the other hand, suspension cannot be used alone since the length would give the bridge a great lack of rigidity—which rigidity is essential in constructing spans the length of the one contemplated. The two main cables which would be necessary to support the bridge would be one mile in total length and would weigh approximately 5,250 tons. Their cost would closely approximate two and a half million dollars. The width of the roadway space would be eighty feet; there would be one single deck only. The suspension span would be 750 feet longer than the proposed Hudson River bridge. One of the chief problems confronting Mr. Strauss in the design of this bridge was the fact of the existence of very high winds at the point where the bridge is to be constructed. The added strain placed on the structure by this element had necessarily to be considered at every point.

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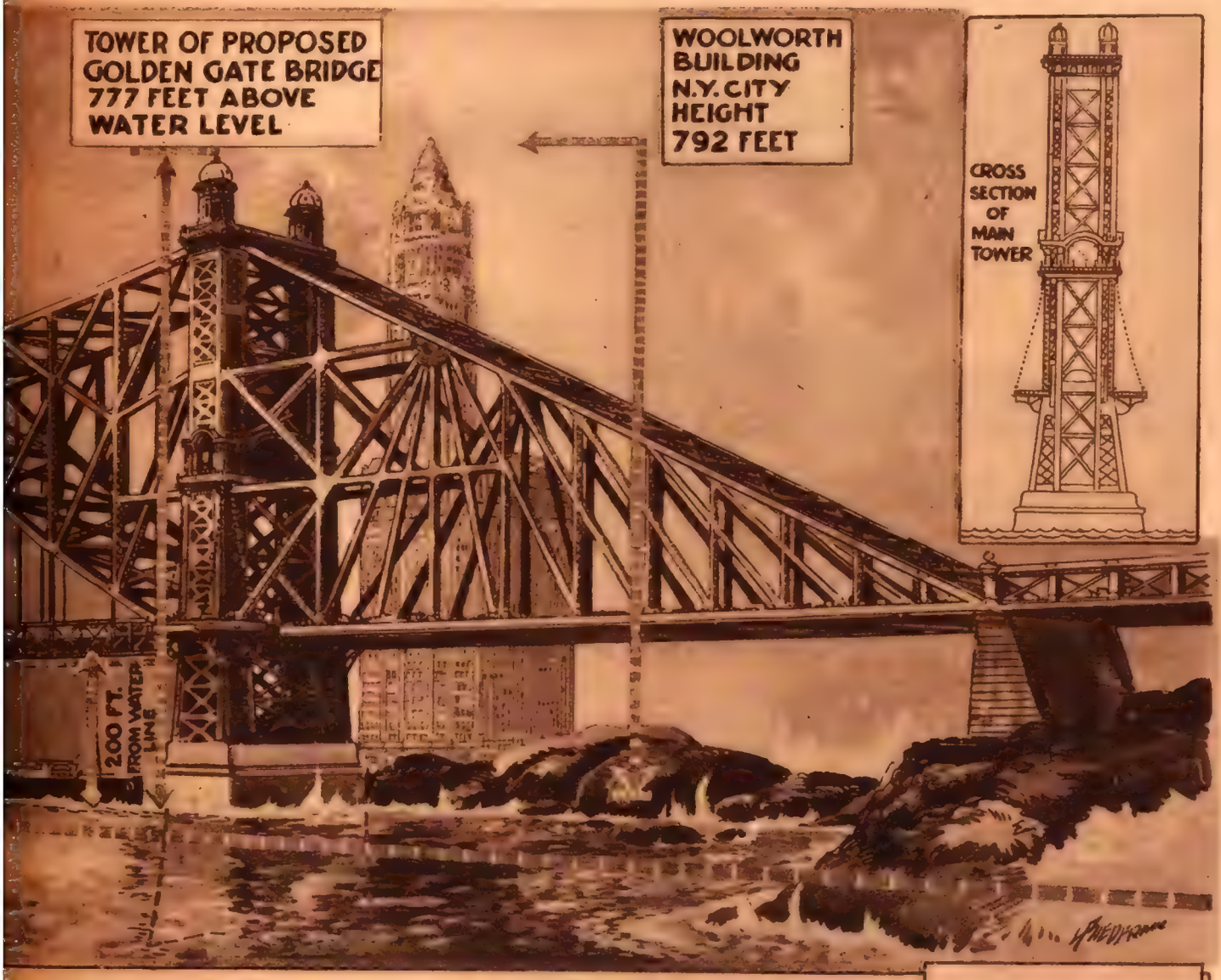
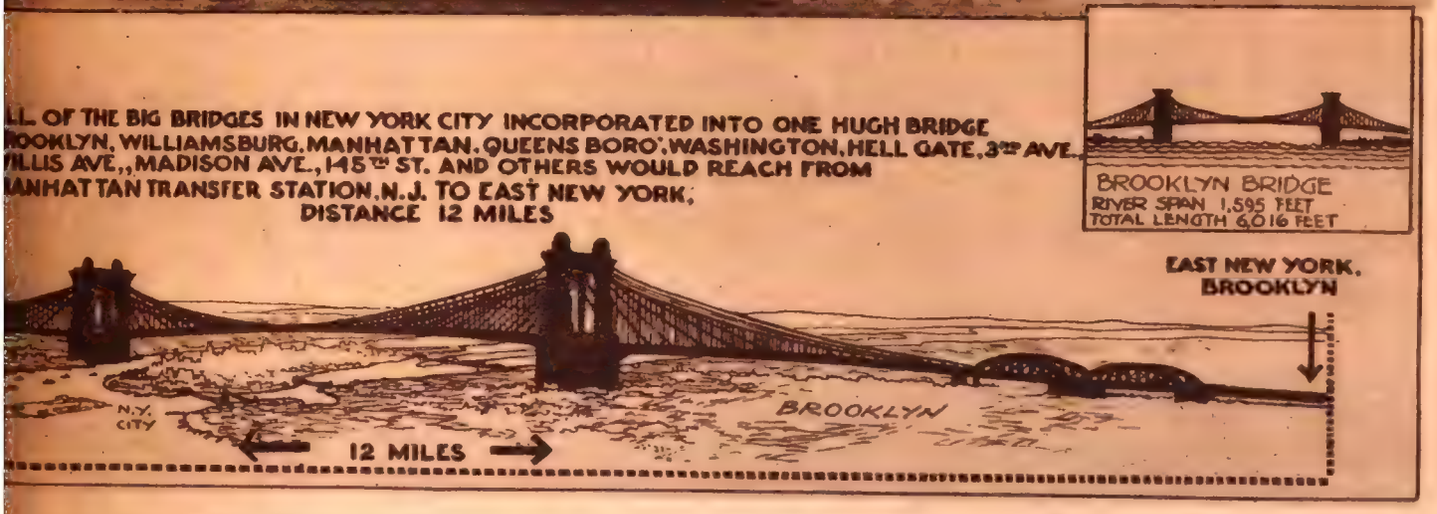
Original from UNIVERSITY OF C

for Golden Gate

Structure to Cost $17,000,000


TOWER OF PROPOSED GOLDEN GATE BRIDGE 777 FEET ABOVE WATER LEVEL
WOOLWORTH BUILDING N.Y. CITY HEIGHT 792 FEET
CROSS SECTION OF MAIN TOWER
200 FT. FROM WATER LINE


L. OF THE BIG BRIDGES IN NEW YORK CITY INCORPORATED INTO ONE HUGH BRIDGE
OOKLYN, WILLIAMSBURG, MANHATTAN, QUEENS BORO', WASHINGTON, HELL GATE, 3RD AVE.
ILLIS AVE., MADISON AVE., 145TH ST. AND OTHERS WOULD REACH FROM
ANHATTAN TRANSFER STATION, N.J. TO EAST NEW YORK,
DISTANCE 12 MILES
BROOKLYN BRIDGE
RIVER SPAN 1,595 FEET
TOTAL LENGTH 6,016 FEET
EAST NEW YORK, BROOKLYN
N.Y. CITY
BROOKLYN
12 MILES

In the top illustration above is shown a comparison between the height of the Woolworth Building, the highest structure in New York, and the height of the towers which will support the proposed San Francisco bridge. Elevators will be installed in the towers which will carry observers to galleries which will be built at their tops. This will give a wonderful view of all the San Francisco harbor. A cross-section of the tower showing the method of construction is given in the insert at the top drawing.

Speaking of bridges, we see graphically illustrated below Mr. Charles Nevers Holmes' idea of giant New York bridges. The large 12-mile bridge shown incorporates all the New York bridges built in the last 54 years. Were this 12-mile bridge stretched across from New Jersey to Long Island, it would pass clear over Manhattan Island, having one pier built on the Jersey shore; the other would fall toward the center of Brooklyn, while the approaches would carry the total length clear across the width of Brooklyn and well over towards the center of Jersey City. In the inset is shown the comparative size of the famous Brooklyn Bridge.

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Preparations Made For

Huge Tanker Rebuilt as Mooring Vessel

BY GRASER SCHORNSTHEIMER

The contemplated trip of the world's largest airship the *Shenandoah* to the North Pole, entails much more preparation than the mere plotting of a course and filling the tanks with gasoline. One of the first necessities which had to be met by naval engineers in preparing for this flight was the building of some sort of a movable mooring base. They hit upon the plan of building a mooring mast aboard a vessel. The mast will be very similar to the one now used by the big ship at its base at Lakehurst, N. J. This mast is shown in the illustration at the left. A duplicate of this mast will also be erected at some point probably up near the Arctic Circle in Alaska, which will serve as a starting base for the last leg of the Trans-polar flight. A temporary base with supplies and repair-shop will be built at the same place.

This relief map shows a number of the various proposed routes which may be settled upon by the Naval engineers for the flight. One of the chief reasons for the Trans-polar trip is to make discoveries through a large unexplored area which lies between Cape Barrow, Alaska and the Pole. A study of weather conditions, fuel and supply possibilities, will probably be the final factors in the selection of the route finally taken. The flight will end at Spitzbergen where the *Patoka*, the mooring ship pictured at the bottom of the opposite page, will be stationed to await the dirigible's arrival. The unexplored area on the map has been the subject of a great amount of conjecture. It has been said that a warm continent heated probably from a geyser or a volcanic formation exists in this area.

Here is shown the United States ship *Ramapo* as she now appears. She was originally built as an oil tanker for the Emergency Fleet Corporation. She will be rebuilt as a mooring vessel for the *Shenandoah*. She has a displacement of approximately 17,000 tons.

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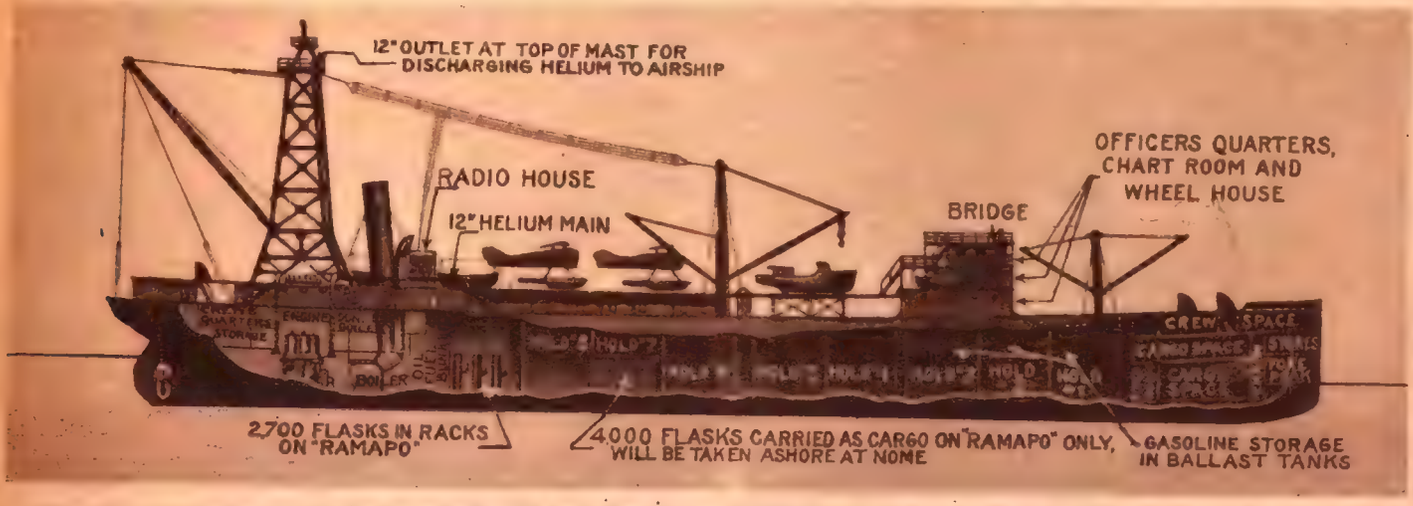
Shenandoah's Polar Flight

The Discovery of Warm Polar Continent a Probability

NAVAL ENGINEER

Above we have a drawing showing how the *Patoka* will look fitted out for her rôle of mooring vessel for the *Shenandoah*. The vessel will have a small mooring mast, will have ample storage capacity and carry an emergency supply of helium gas for the use of the airship. She will also be equipped with a repair shop from which any necessary repairs incurred during the flight may be remedied before she starts on her return voyage. There will also be a sort of airplane hangar aboard the vessel where airplanes will be carried.


12" OUTLET AT TOP OF MAST FOR DISCHARGING HELIUM TO AIRSHIP
RADIO HOUSE
12" HELIUM MAIN
OFFICERS QUARTERS, CHART ROOM AND WHEEL HOUSE
BRIDGE
CREW'S SPACE
2,700 FLASKS IN RACKS ON "RAMAPO"
4,000 FLASKS CARRIED AS CARGO ON "RAMAPO" ONLY, WILL BE TAKEN ASHORE AT NOME
GASOLINE STORAGE IN BALLAST TANKS

What the cross-section of the *Patoka*, rebuilt, will look like when she leaves for her trip to Spitzbergen; note that she will run practically empty. One of the outstanding points of construction in this vessel is the installation of the helium storage tanks, aft, and the installation of piping from the tanks up the mooring mast and to hose so that the giant airship may have her supply of gas replenished with the least possible expenditure of time and trouble. The details of construction of the mooring mast are plainly shown.

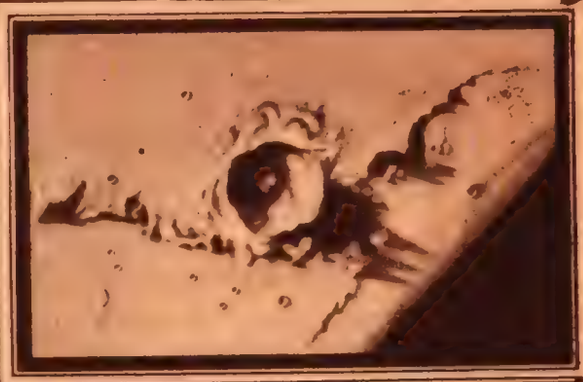
Google Original from

The Transit of Mercury

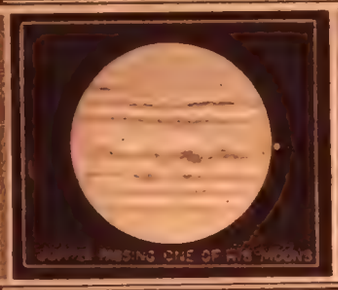
The Planet Will Pass Between Earth and Sun May 7

BY DONALD H. MENZEL

Above is shown a total eclipse of the sun observed at the Harvard Observatory August 7, 1869. The transit of a planet is practically the same thing but the planet does not obscure the face of the sun. On May 7 Mercury will pass across the sun in the same manner.

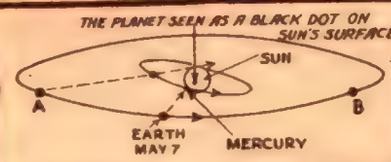


A very good view of the moon occulting a star is photographed above. When the moon occults a star it disappears immediately since the moon has no atmosphere. The occulting of a star by the moon is used by mariners at sea for obtaining correct time.



Above Jupiter is seen passing one of his own moons. This is an illustration of what will happen when Mercury makes his transit. Photo Harvard Observatory.

At the left is an illustration of the planet's transit at different points throughout the United States. The first contact will be at 4:32, Eastern Standard Time.



Immediately above is a diagrammatic scheme of the orbits of the earth and Mercury showing how the intersection of their planes, while both are in line with the sun, gives the effect of the transit.

In olden times when eclipses could not be predicted, panic was created by their appearance. It was a terrible thing to the ancients to see the face of the sun obscured during daylight hours. Many times it caused extreme fright, since it was considered a sign of the wrath of the Gods.

A transit of Venus is a much more beautiful sight. The planet has an extensive atmosphere so that the planet's disk is ringed with a pearly halo during its passage across the sun. Probably Mercury has little if any atmosphere.

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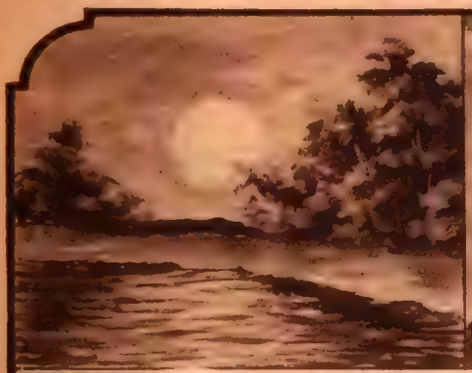
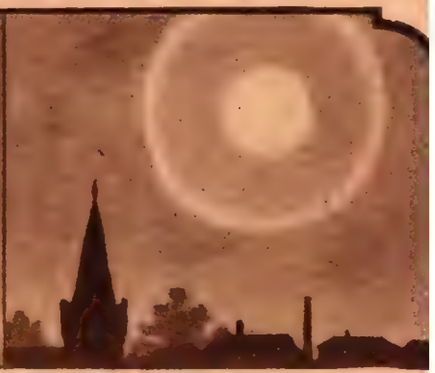
Weather Legends and Proverbs

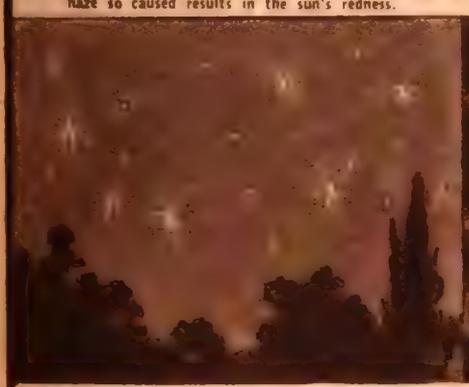


One of the oldest weather legends is that a red sun has water inside. The condition most favorable to a red setting sun is a large quantity of dust and smoke particles in the air. These gather moisture and the haze so caused results in the sun's redness.

A morning rainbow often leads sailors to look carefully at the barometer. A morning rainbow means that the air is rather humid and rain is likely, for a shower has occurred with but little rise of air and slight cooling, leaving the water particles close to earth.



Many farmers will tell you that the number of stars in a moon corona will indicate the number of days before the next rain. The corona itself is caused by diffraction. Water droplets in the air cause the moon's corona.



That twinkling stars are a sure weather indication is one of the most tenacious proverbs known to weather prophets. Stars twinkle because of atmospheric differences caused by foreign substances in the atmosphere. Much dust or fog will cause twinkling.

The cause of fog is the cooling of the surface air to a point below its dewpoint. In summer radiation may cause fog and in winter fogs are caused by an influx of humid air from a body of water. Summer fogs indicate fair weather, winter ones a storm.

High clouds having required much cooling to form do not contain enough humidity to produce any considerable rain or snow. Therefore, the old proverb: "High clouds, fine weather" is substantially correct. The woolpack or cumulus indicate fair weather.

Thunder has evoked few proverbs. About the only one is that spring thunder brings a cold wave. There is little foundation for this proverb and its origin has no scientific foundation since thunder showers are usually caused by the upward movement of humid air.

Some people, it is said, can "smell rain." This is due to the fact that an approaching storm brings with it a rise in the pressure of the atmosphere of the earth's surface, releasing small amounts of the decaying organic gases which escape into the atmosphere.

Lowering smoke is a well known indicator of foul weather ahead. When the air is excessively humid small particles of moisture gather around the smoke particles as a nucleus and cause it to bear down much nearer the earth. In dry weather it is free and rises.

Another strange omen which has no scientific foundation is that those afflicted with neuralgic or rheumatic pains suffer their illness more just previous to a storm than at any other time. See "Weather Proverbs and Parodies," by Dr. W. J. Humphreys.

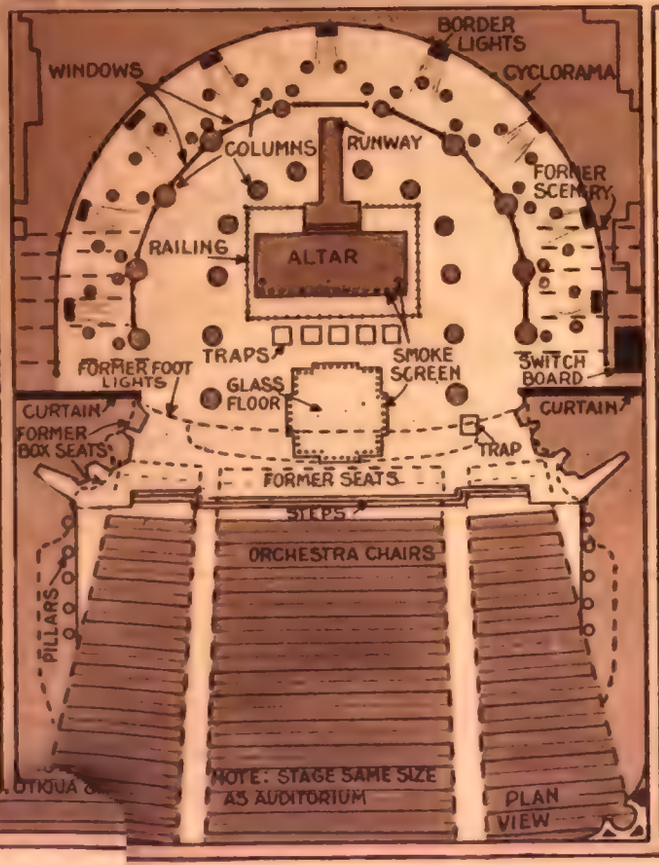
One of the most widely adhered to superstitions is that known as "Groundhog Day." Whence this old idea arose is a much disputed question, as it is quite obvious it has no foundation of any kind, says E. B. Dunn, weather expert.

If Saint Swithin's Day is rainy it is supposed to predict a continuation of the rain for forty days—but it never has. The legend runs that pious people attempted to move the body of the Saint on July 15 and that it rained for forty days, preventing them

Google

"The Miracle", of

By W. B.



THE engineers and the electricians who carried out Mr. Max Reinhardt's ideas in the production of "The Miracle" at the Century Theatre in New York City, deserve wide publicity and praise for surmounting the greatest obstacles that have ever confronted American stage technicians. Above may be seen the archway which takes the place of the old-time proscenium. The whole theatre had to be rebuilt in the form of a cathedral. The stage was entirely taken away and extended out into the auditorium until the length of the stage is equal to the length of the auditorium. Boxes had to be torn out, all the side lighting and exits had to be covered and an entirely new system of lighting installed in the entire theatre. The orchestra was removed to the second balcony. Huge stained glass windows were erected, rising sixty feet above the floor. A high tower was built at one side of the archway extending from the level of the stage up 125 feet to the roof of the theatre. Since there is no stage at all (half the characters of the play file up the aisles of the auditorium and a part of the action of the play actually takes place with the cast within touching distance of the audience) a means had to be devised to shut off the view of the audience for the scene changes. They finally contrived the plan of using a smoke screen which is illustrated at the right. A salt and acid compound which is a secret of the producers, is used to fill this need. The smoke is a dense black, perfectly opaque, is tasteless and has no odor. The method used for producing the smoke screen is illustrated at the right. In the plan view at the right is shown the changes that had to be made in the interior arrangement of the theatre for the production. The dotted lines illustrate where the boxes, footlights, and sidewalls formerly were situated. The heavy lines show the present arrangement.

Google

a Wonder Stagecraft

ARVIN

This perspective view of the inside of the Century Theatre as it appears remodeled for this gigantic production, gives a clear idea of some of the problems which the stage technicians had to solve. A huge pipe organ had to be installed behind the stained glass windows, which appear high up above the second balcony. (These windows were made by painting the designs on a fine wire mesh.) The huge columns extend to the top of the theatre. They serve as scenery and as channels from which to slide the windows back of archway up out of the way with change of scene. Stage property is handled by cables from grid-iron.

MICROPHONE SEWED IN COSTUME

CHEMICAL POTS

LIGHTS

(C)1924 BY SCIENCE & INVENTION

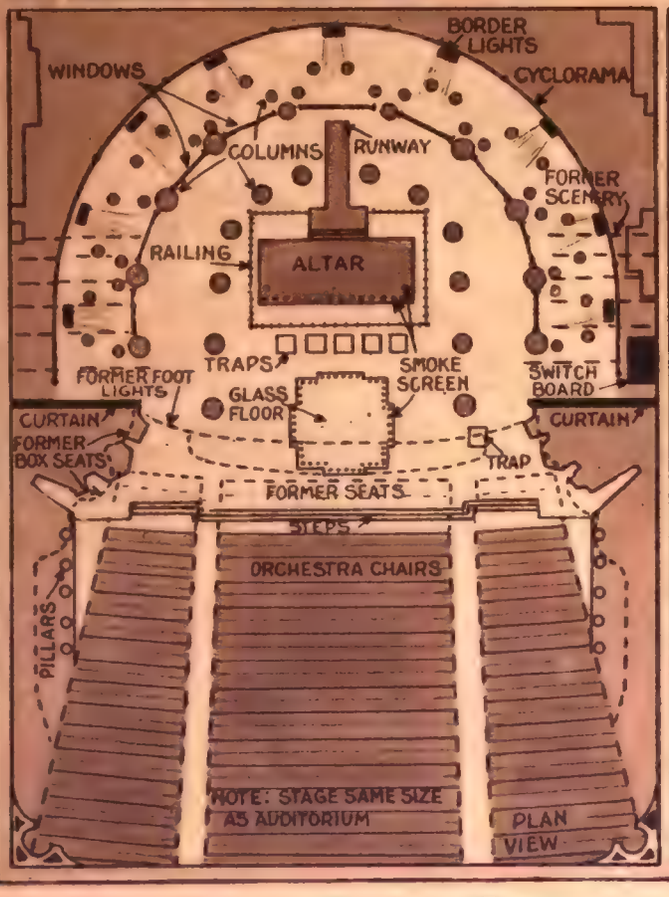
In the insert at A is shown Chief Electrician Eugene Braun and his stage director giving orders to the special switchboard, insert B. Note where the spotlights are located in the drawing at the top of the page. Immediately above is shown the stage manager who has a costume in which a microphone is attached for every mob scene. At F is the tall tower extending to the top of the theatre. At G is a pulpit. D shows the smoke screen outlet; H are traps. E is a heavy oaken door.

At the left is shown the altar which by the simple expedient of being divided in the middle as shown, serves as an altar, a doorway and an imitation pipe organ in each of three different scenes. Directly above is shown a torch bearer in one of the mob scenes. The light of the torch is furnished by two electric bulbs and the smoke is from chemical pots. The lighting cable attaches to floor plugs. At C in the top drawing is shown a companionway through which the cast enters the stage.

Google

"The Miracle", of

By W. B.



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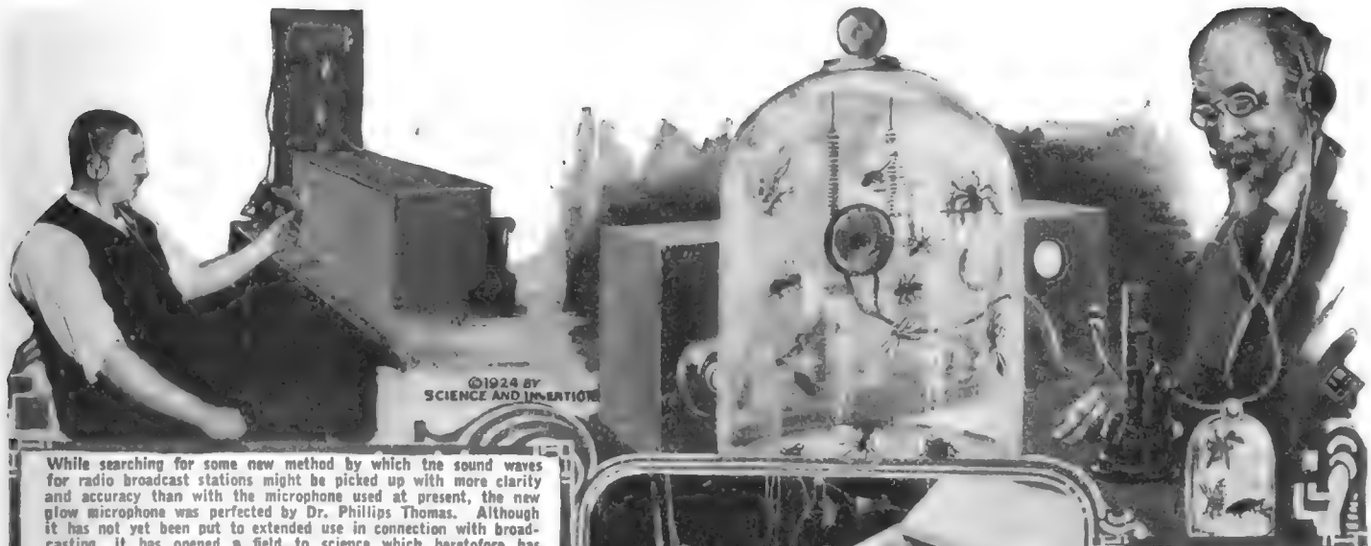
Insect Sounds Now Audible

New Microphone Sensitive to Ultra Audio-Frequencies

By W. W. RODGERS*



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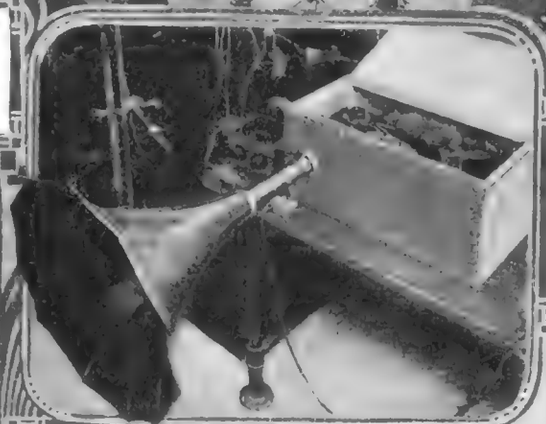
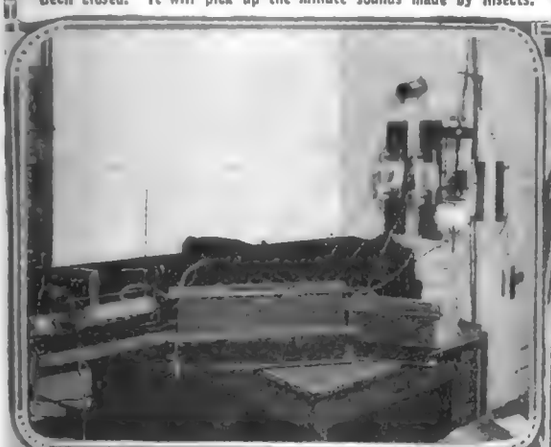
While searching for some new method by which the sound waves for radio broadcast stations might be picked up with more clarity and accuracy than with the microphone used at present, the new glow microphone was perfected by Dr. Phillips Thomas. Although it has not yet been put to extended use in connection with broadcasting, it has opened a field to science which heretofore has been closed. It will pick up the minute sounds made by insects.



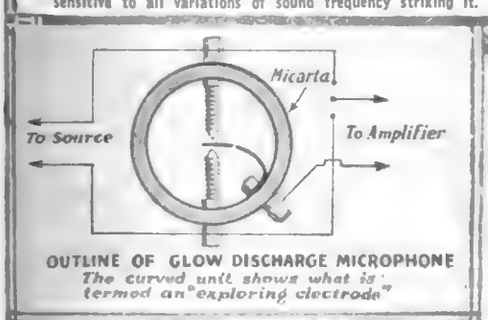
In order to pick up the sounds of insects it will be necessary to suspend the microphone in a jar where the insects are confined and to pass the current from the microphone through an ordinary radio receiver. At the left is shown the glow microphone attached to a horn. Below Dr. Thomas is "hearing" one million vibrations per second.



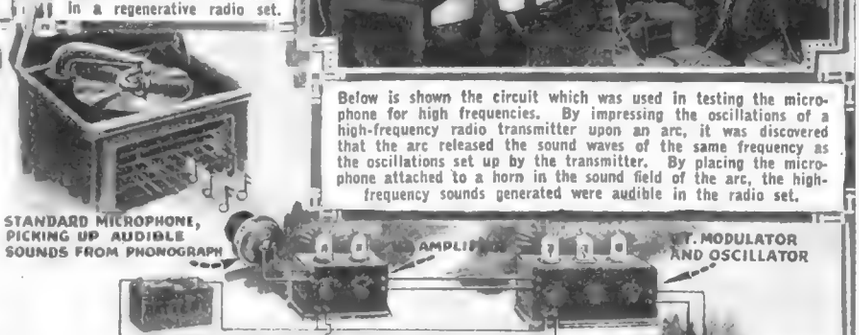
The glow microphone is nothing more than two electrodes connected to a direct current source between which is placed a third electrode, as shown below. All three electrodes are mounted on an insulating ring. If the current is so adjusted that only a glow is produced across the electrodes instead of the usual direct current arc the instrument will be extremely sensitive to all variations of sound frequency striking it.

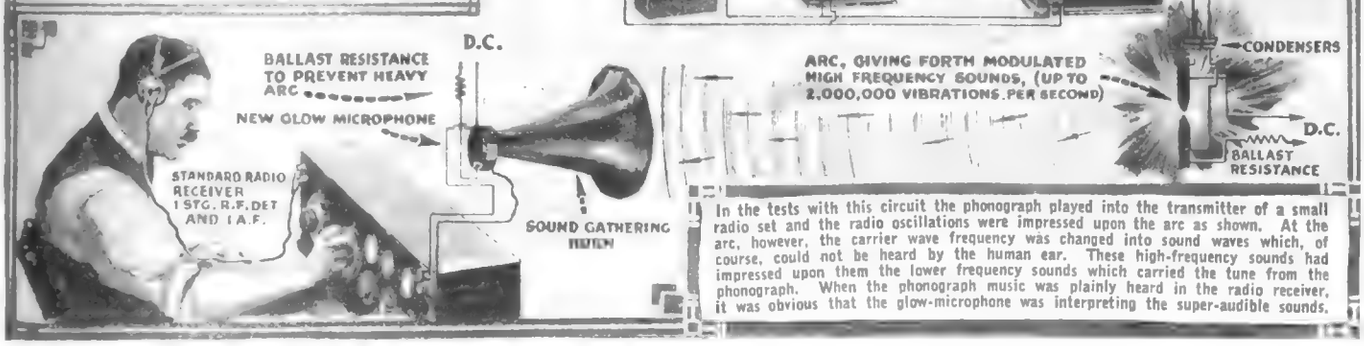
The high frequency sounds are made audible through the use of the heterodyne effect, i.e., by causing the high frequency sounds picked up by the glow microphone (translated into an electric current) to be impressed on a radio receiver, and allowing a second series of oscillations of nearly the same frequency to interfere with them; the two oscillations coming together form an audible beat note, which is similar to that heard in a regenerative radio set.

Below is shown the circuit which was used in testing the microphone for high frequencies. By impressing the oscillations of a high-frequency radio transmitter upon an arc, it was discovered that the arc released the sound waves of the same frequency as the oscillations set up by the transmitter. By placing the microphone attached to a horn in the sound field of the arc, the high-frequency sounds generated were audible in the radio set.



OUTLINE OF GLOW DISCHARGE MICROPHONE
The curved unit shows what is termed an "exploring electrode"




BALLAST RESISTANCE TO PREVENT HEAVY ARC
NEW GLOW MICROPHONE
STANDARD RADIO RECEIVER 1 STG. R.F. DET AND 1 A.F.
SOUND GATHERING HORN
D.C.
ARC, GIVING FORTH MODULATED HIGH FREQUENCY SOUNDS, (UP TO 2,000,000 VIBRATIONS PER SECOND)
CONDENSERS
D.C.
BALLAST RESISTANCE

In the tests with this circuit the phonograph played into the transmitter of a small radio set and the radio oscillations were impressed upon the arc as shown. At the arc, however, the carrier wave frequency was changed into sound waves which, of course, could not be heard by the human ear. These high-frequency sounds had impressed upon them the lower frequency sounds which carried the tune from the phonograph. When the phonograph music was plainly heard in the radio receiver, it was obvious that the glow-microphone was interpreting the super-audible sounds.

*Of the Westinghouse Electric & Mfg. Co.

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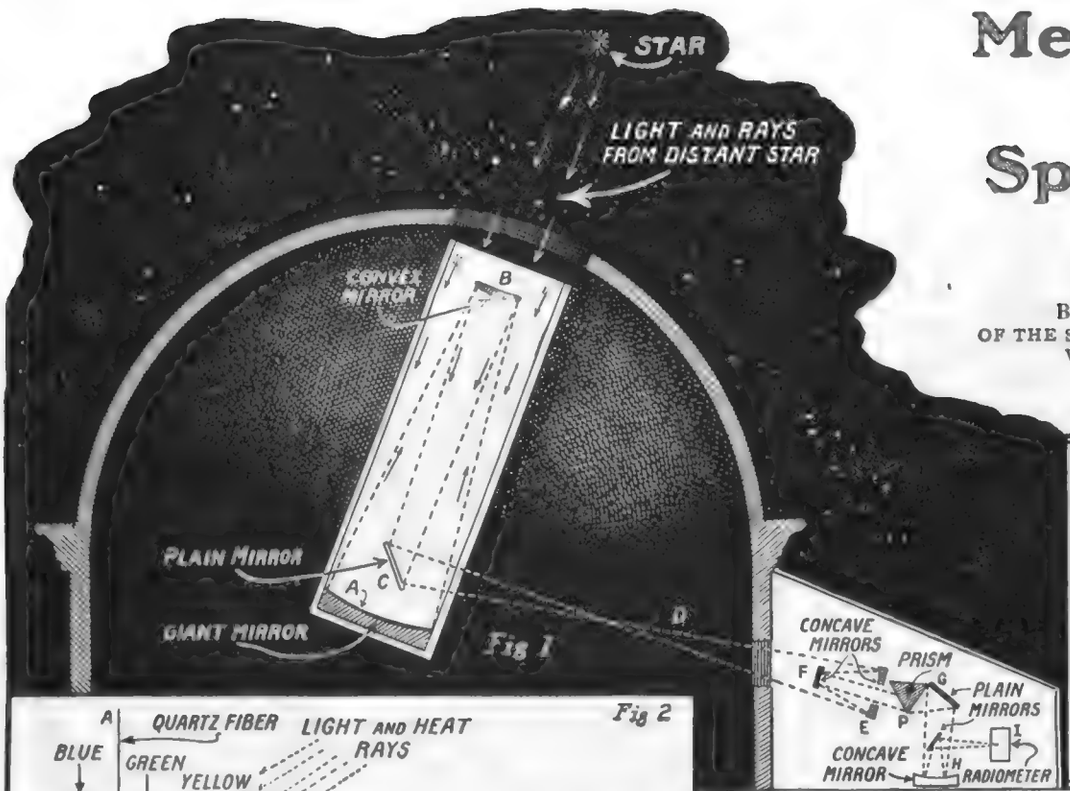
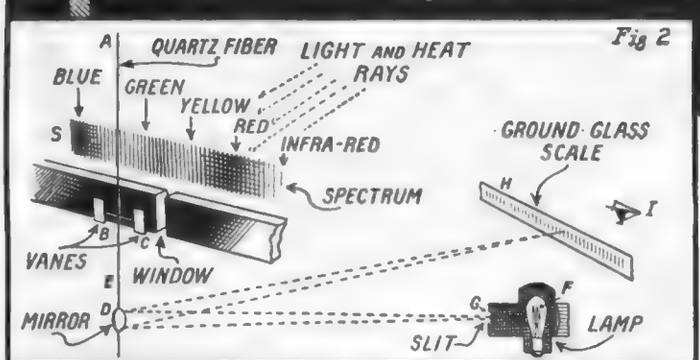
Measuring Star Spectrum Heat

BY DR. C. G. ABBOT
OF THE SMITHSONIAN INSTITUTION
WASHINGTON, D. C.



Mt. Wilson Observatory has succeeded in measuring the heat of the different parts of the spectrum of stars. At the left is shown the method in which the sensitive measuring instruments were used. It will enable us to know more thoroughly the constitution or spectral distribution of the lights of different stars. Light from the star reaches the great mirror, A, is reflected to B, thence to C, through focal point D to concave perforated mirror E. From this point it is reflected to concave mirror F, returning through hole in E and strikes 60° glass prism P, producing spectrum which strikes radiometer I.



The above shows the sensitive instrument which measures the power of the light rays and their temperature. A quartz fibre, A, thinner than a spider's web carries two vanes, B and C, and a mirror D. A movable slot in front of the vane, C, allows the particular portion of the spectrum which is to have its heat measured to fall on the vane. The heat force of the ray acting on the vane causes the mirror to rotate, twisting the fibre, and reflecting a beam of light from the incandescent lamp, F, upon the ground glass scale, H.

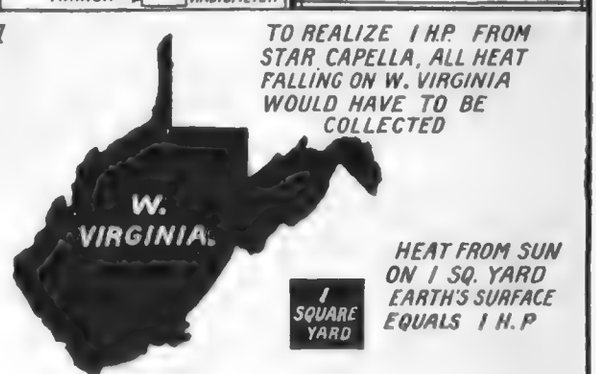
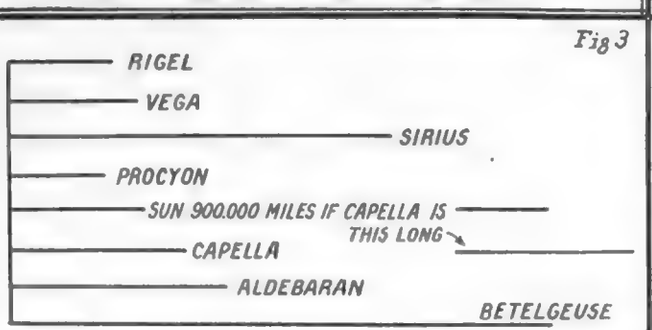
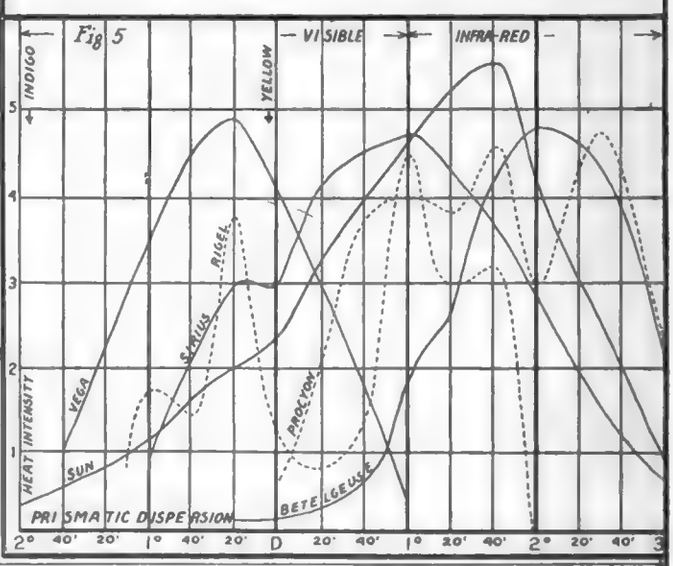


Fig 4
TO REALIZE 1 H.P. FROM STAR CAPELLA, ALL HEAT FALLING ON W. VIRGINIA WOULD HAVE TO BE COLLECTED
W. VIRGINIA
1 SQUARE YARD
HEAT FROM SUN ON 1 SQ. YARD EARTH'S SURFACE EQUALS 1 H.P





Some idea as to the minuteness of the measurements made by the Mt. Wilson astronomers may be gained by referring to Fig. 4. It has been ascertained that the heat of the sun falling on one square yard of the earth's surface produces practically one horse-power, while to realize the same amount of power from a representative star of the first magnitude, Capella, the whole area of the state of West Virginia would be necessary. In Fig. 3 is illustrated the comparative heat of various stars with that of the sun. The line representing the heat of the sun would stretch away 900,000 miles if a line representing the heat from Capella is one inch in length.

These measurements, of course, are of the heat of the celestial bodies affecting the earth. Some of them it has been well established, are many times hotter than our own sun. Some idea of the importance of these measurements and of the interest they excited in scientific circles may be gained from the chart at Fig. 5, which shows the heat curves of the stars in both the visible and invisible portions of their spectra. Heretofore the heat and contents of the stars had been judged solely from their visible spectrum. Note that in the present measurements, in the case of the sun and Betelgeuse, a large portion of their heat curves fall in the invisible portion of the spectrum. Before the present measurements were made, astronomers long held the opinion that both Vega and Sirius should be considered blue-white hydrogen stars with few lines showing in their photographic spectrum. It was also thought that they were both nearly twice as hot as our sun. The new measurements disclosed that Vega's maximum heat was nearer the violet end of spectrum than that of sun.

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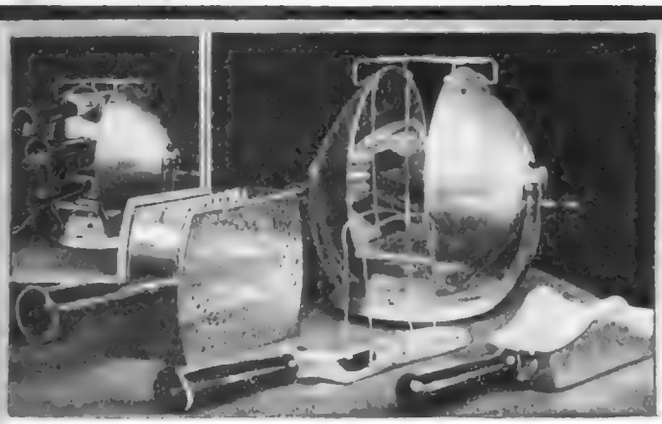
The Month's New Devices



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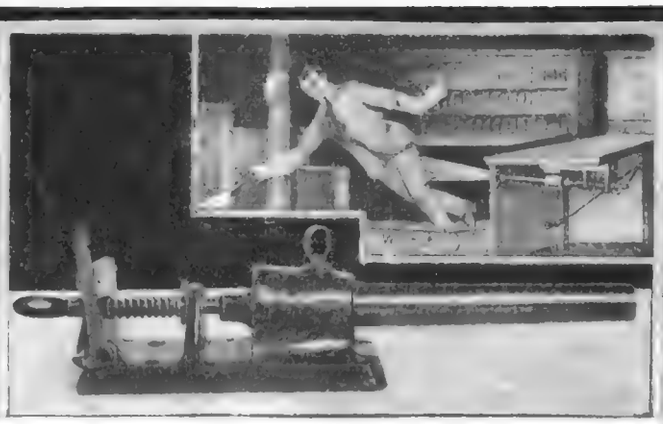

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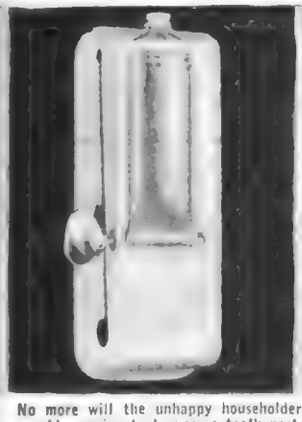

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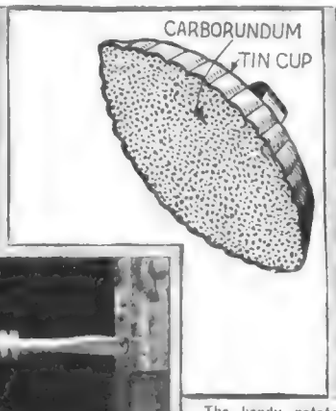

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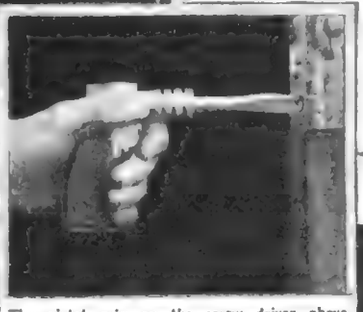

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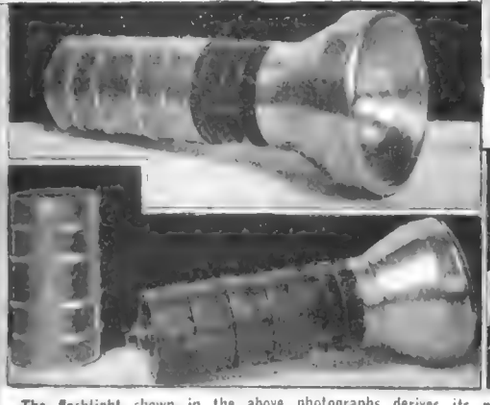

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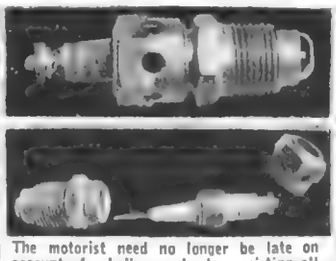

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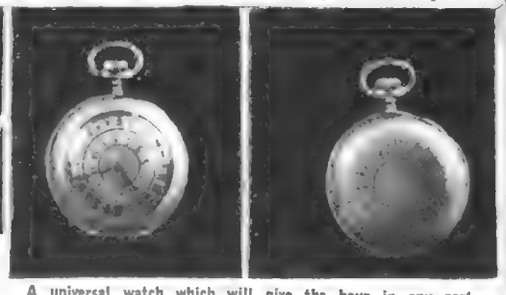

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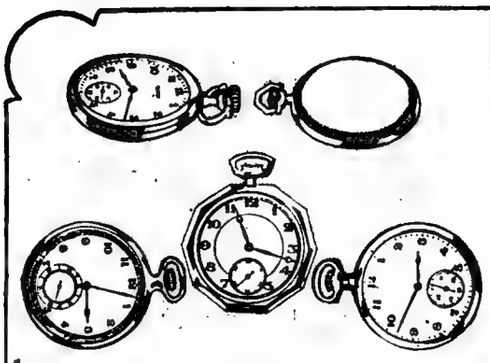
Timely Talks on Timepieces

No. 1 of a Series. Hints on Maintenance

By SAMUEL BERNARD



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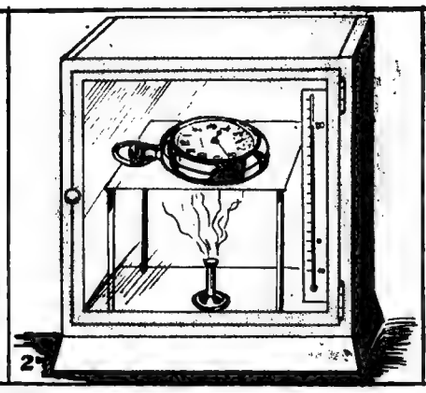

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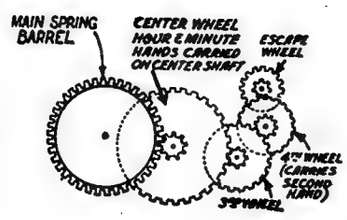
If the timepiece in the pocket of an engineer on a transcontinental train were not carefully adjusted for all changes in temperature, the result would very probably be a screaming headline in the daily press telling of scores of deaths and terrible property losses. All manufacturers of watches which serve where exact time is a necessity, subject their product to the most severe temperature adjustments. As illustrated here each completed watch is placed in a case with a thermometer and is passed through the whole range of temperatures from 40° below zero, Fahrenheit, to 120° above. At a number of temperatures the watch is readjusted.


MAIN SPRING BARREL
CENTER WHEEL HOUR & MINUTE HANDS CARRIED ON CENTER SHAFT
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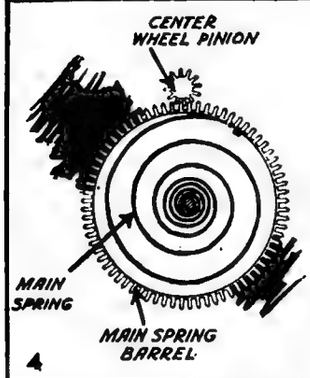
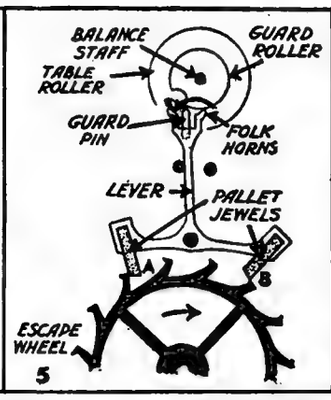
In the final analysis a watch is nothing more than a train of gears which magnify the speed of the minute and hour hands to an extent where they may be adjusted with more or less ease to the greatest possible accuracy. Above is shown such a train of gears and the method in which the main spring which is the motor that runs the watch, is attached to it. The train adjusts the speed of the minute and hour hands. The small escape wheel governs the entire movement of the train. The fourth wheel just after the escape wheel, carries the second hand and makes one complete revolution to each sixtieth of a revolution of the large center wheel carrying the minute hand.



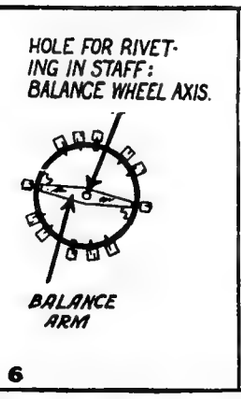
4

All standard pocket timepieces have a main spring. The outer end of the spring is attached to the barrel which is toothed and is geared to a small pinion on the last wheel of the gear chain which carries the minute and hour hands. The inner end of the spring is attached to the shaft which works on a ratchet and is connected by a separate chain of gears to the stem of the watch, by means of which the spring is rewound.



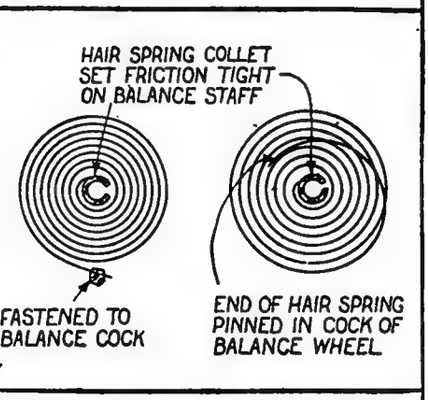
5

The heart of the watch is the escapement movement which is shown above. As the escape wheel rotates the two jeweled arms move the lever to which they are attached first in one direction and then in the other, regulating the speed at which the escapement wheel revolves and thereby regulating the speed of the watch, since the escapement wheel governs the train of gears. The pallet jewels prohibit wear, which would have a very definite effect on the watch's adjustment.



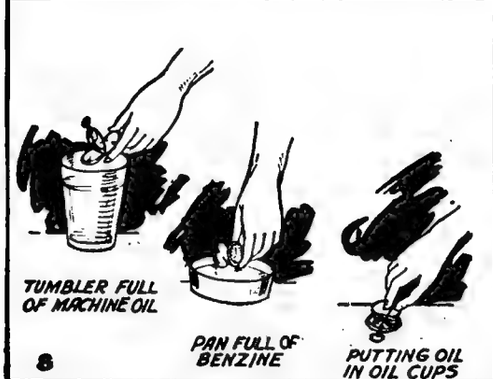
6

The modern balance wheel is made of two metals similar to a thermostat and is finely balanced with a number of screws around its periphery. The bi-metallic construction of the wheel allows for temperature changes. A reduction in temperature which would cause the balance wheel to contract, and speed up is compensated for by the bi-metallic construction, keeping the speed even.

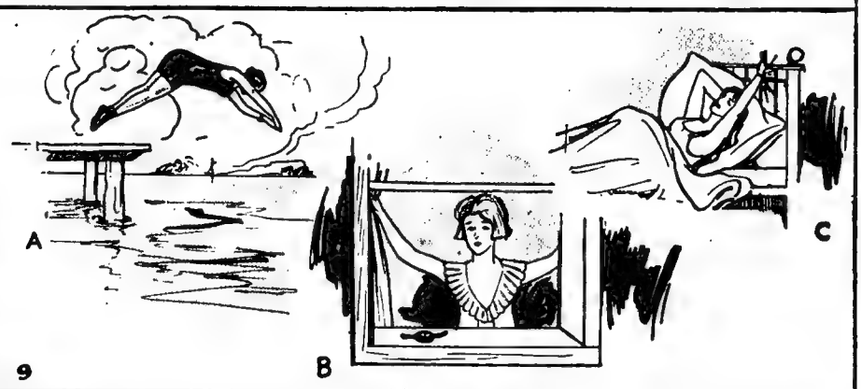

HAIR SPRING COLLET SET FRICTION TIGHT ON BALANCE STAFF
FASTENED TO BALANCE COCK
END OF HAIR SPRING PINNED IN COCK OF BALANCE WHEEL

7

To the balance wheel shaft is attached a small spring called the "hair spring" which with its tension forces the balance wheel to swing to and fro. In the above illustration is shown the method in which the spring is attached, one end being made fast to the shaft and the other to a small metal block called "the balance cock," which is attached to the frame of the instrument. The end of this spring which is fast to the frame, usually carries an adjustment for tension through which rough adjustments may be made. It is this adjustment that the jeweler moves when you tell him your watch is running too fast or too slow.



8



9

Many a watch is thrown away because it had a salt water bath. To prevent its being ruined the simple process illustrated above may be used. While the watch is still wet or as shortly after the accident as is possible, open the case of the watch both back and front and immerse the whole mechanism in a tumbler of machine oil. Allow the watch to remain in the oil for a few days. After the watch is thoroughly soaked in the heavy oil, remove it and rinse it thoroughly in a pan of benzine which has been strained through chamois. After it has been thoroughly [illegible] the heavy oil by this method, allow it to rest in some undisturbed spot [illegible] no dust until the benzine is evaporated. Then oil each cup at the [illegible]ng shafts and put a very small drop of oil on the two pallet jewels.

Wrist watches are notoriously poor time keepers. Always remove your wrist watch before taking a plunge. Water is very bad for marcelle, so it must be infinitely more harmful to the delicately balanced mechanism of a fine wrist watch. Too, it is not the best proposition in the world to allow a wrist watch to lie near an open window or over a hot radiator, or in fact, in any position where it will be subjected to extreme temperatures. The same effect is inflicted on the watch by hitting it with an eight-ounce hammer as slamming it against the brass bed when one takes one's morning stretch. Obviously both methods of mistreatment should be studiously avoided if the watch is to be used as a time-keeper and not merely for ornamental purposes.

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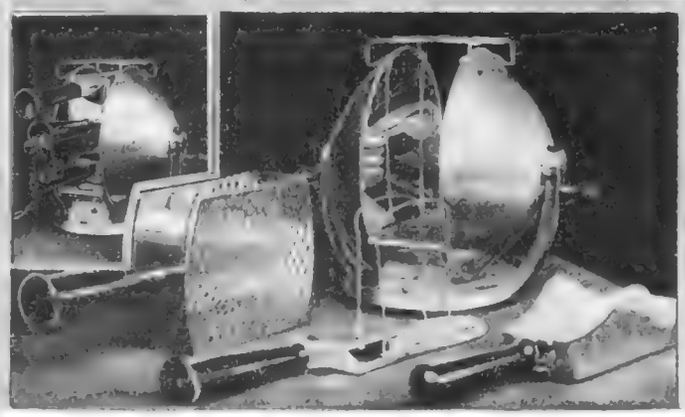
The Month's New Devices



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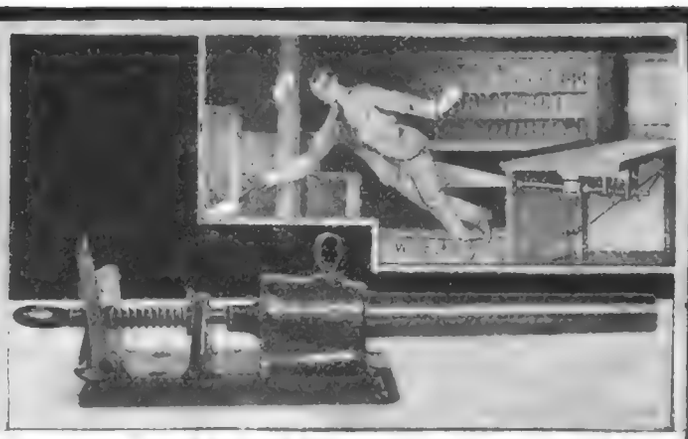

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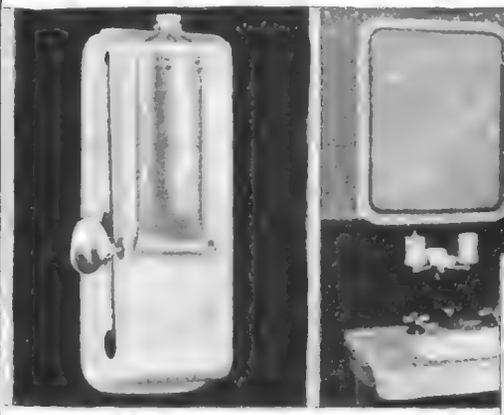

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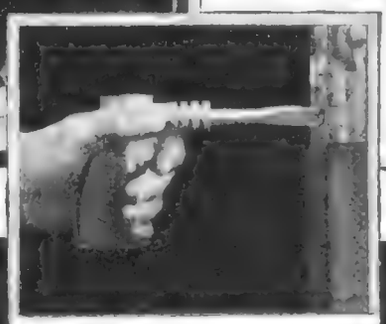

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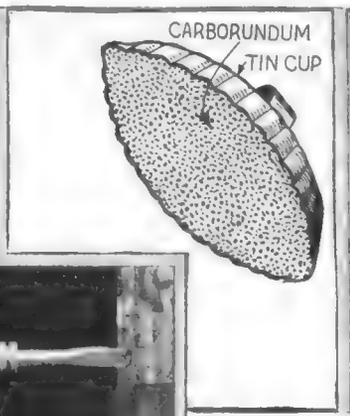

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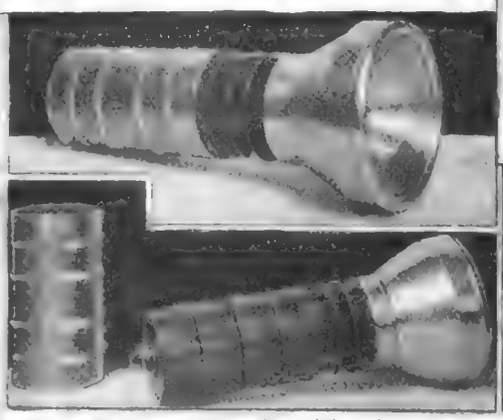

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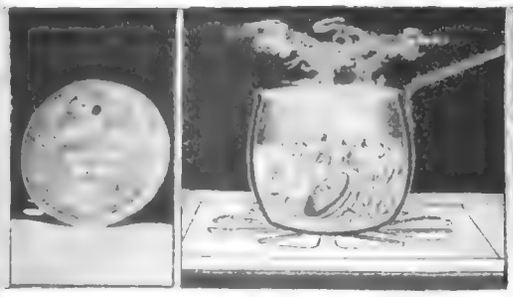

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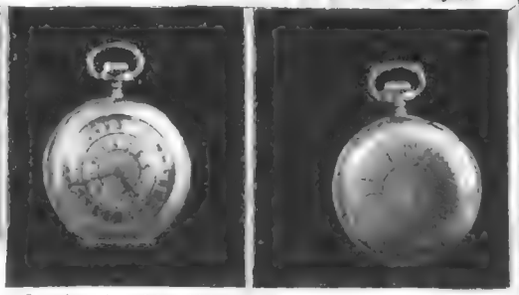

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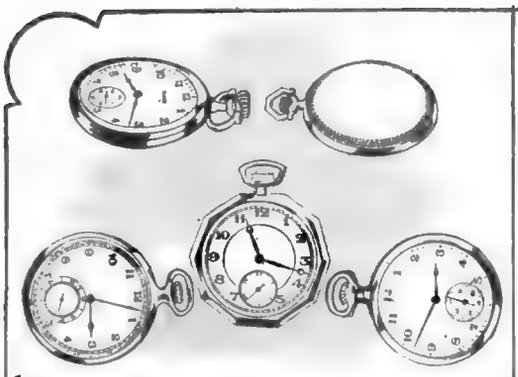

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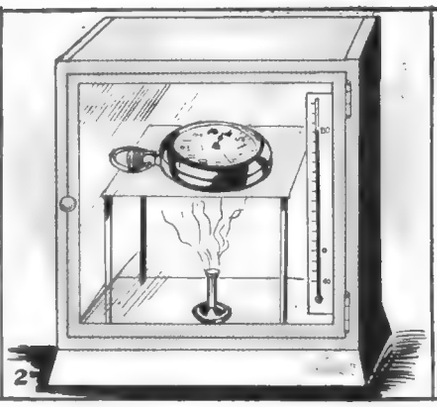

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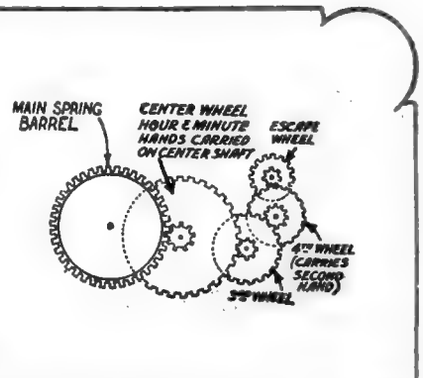
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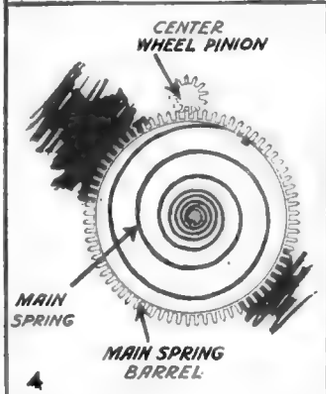
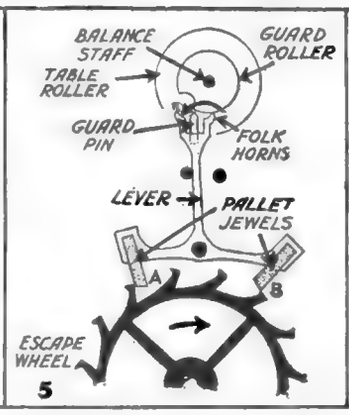
3

In the final analysis a watch is nothing more than a train of gears which magnify the speed of the minute and hour hands to an extent where they may be adjusted with more or less ease to the greatest possible accuracy. Above is shown such a train of gears and the method in which the main spring which is the motor that runs the watch, is attached to it. The train adjusts the speed of the minute and hour hands. The small escape wheel governs the entire movement of the train. The fourth wheel just after the escape wheel, carries the second hand and makes one complete revolution to each sixtieth of a revolution of the large center wheel carrying the minute hand.



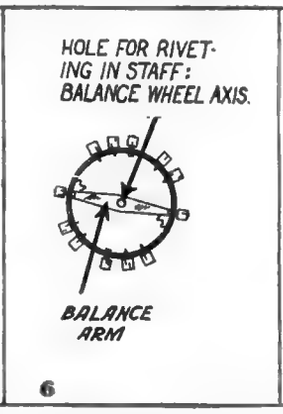
4

All standard pocket timepieces have a main spring. The outer end of the spring is attached to the barrel which is toothed and is geared to a small pinion on the last wheel of the gear chain which carries the minute and hour hands. The inner end of the spring is attached to the shaft which works on a ratchet and is connected by a separate chain of gears to the stem of the watch, by means of which the spring is rewound.



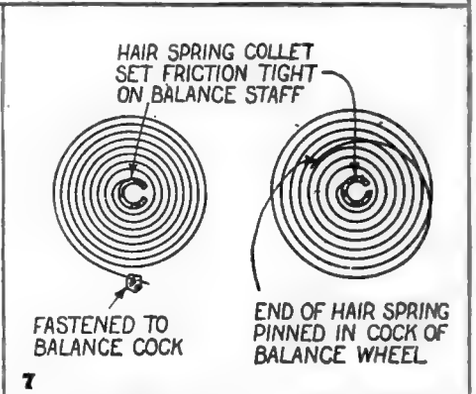
5

The heart of the watch is the escapement movement which is shown above. As the escape wheel rotates the two jeweled arms move the lever to which they are attached first in one direction and then in the other, regulating the speed at which the escapement wheel revolves and thereby regulating the speed of the watch, since the escapement wheel governs the train of gears. The pallet jewels prohibit wear, which would have a very definite effect on the watch's adjustment.



6

The modern balance wheel is made of two metals similar to a thermostat and is finely balanced with a number of screws around its periphery. The bi-metallic construction of the wheel allows for temperature changes. A reduction in temperature which would cause the balance wheel to contract, and speed up is compensated for by the bi-metallic construction, keeping the speed even.


HAIR SPRING COLLET SET FRICTION TIGHT ON BALANCE STAFF
FASTENED TO BALANCE COCK
END OF HAIR SPRING PINNED IN COCK OF BALANCE WHEEL

7

To the balance wheel shaft is attached a small spring called the "hair spring" which with its tension forces the balance wheel to swing to and fro. In the above illustration is shown the method in which the spring is attached, one end being made fast to the shaft and the other to a small metal block called "the balance cock," which is attached to the frame of the instrument. The end of this spring which is fast to the frame, usually carries an adjustment for tension through which rough adjustments may be made. It is this adjustment that the jeweler moves when you tell him your watch is running too fast or too slow.

8

9

Many a watch is thrown away because it had a salt water bath. To prevent its being ruined the simple process illustrated above may be used. While the watch is still wet or as shortly after the accident as is possible, open the case of the watch both back and front and immerse the whole mechanism in a tumbler of machine oil. Allow the watch to remain in the oil for a few days. After the watch is thoroughly soaked in the heavy oil, remove it and rinse it thoroughly in a pan of benzine which has been strained through chamois. After it has been thoroughly cleaned of the heavy oil by this method, allow it to rest in some undisturbed spot where there is no dust until the benzine is evaporated. Then oil each cup at the top of the bearing shafts and put a very small drop of oil on the two pallet jewels.

Wrist watches are notoriously poor time keepers. Always remove your wrist watch before taking a plunge. Water is very bad for marcelle, so it must be infinitely more harmful to the delicately balanced mechanism of a fine wrist watch. Too, it is not the best proposition in the world to allow a wrist watch to lie near an open window or over a hot radiator, or in fact, in any position where it will be subjected to extreme temperatures. The same effect is inflicted on the watch by hitting it with an eight-ounce hammer as slamming it against the brass bed when one takes one's morning stretch. Obviously both methods of mistreatment should be studiously avoided if the watch is to be used as a time-keeper and not merely for ornamental purposes.

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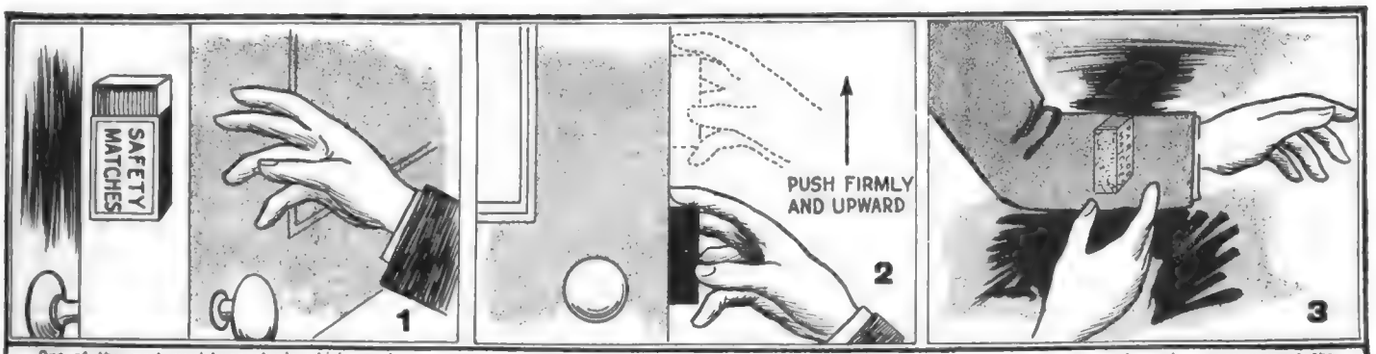
Easily Performed Match Tricks

Mystifying Stunts Which Entertain

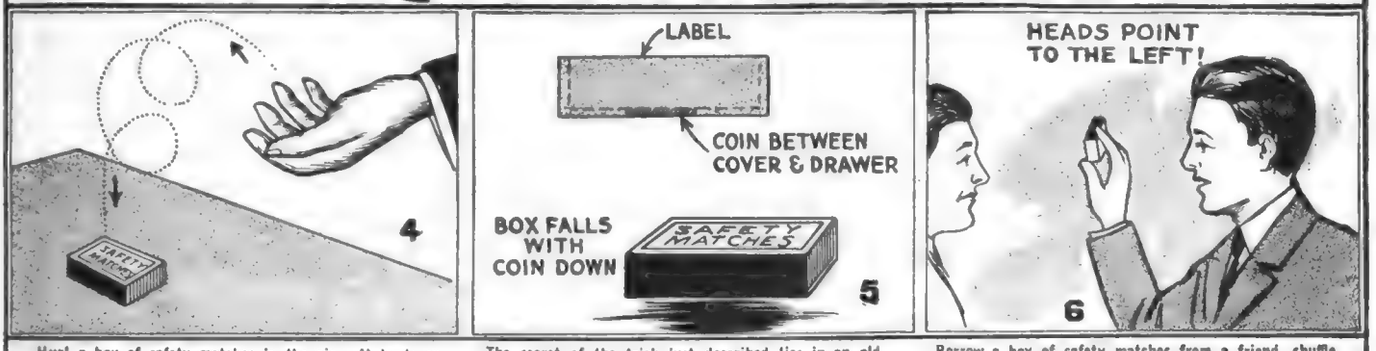
BY WALTER B. GIBSON



One of the most mystifying stunts which can be performed with a box of safety matches is sticking it to a flat surface seemingly without any support. This stunt is performed with apparatus found around any home. Above, the match box is shown sticking to the end of an open door. The surface must be smooth.

The match box may be stuck to the door simply by pressing it firmly against the wood, and at the same time moving it upward. Several trials may be necessary before you can perform the trick. Either an empty or full box may be used. Press the box from sides and corners, as pressure from the top will not work.

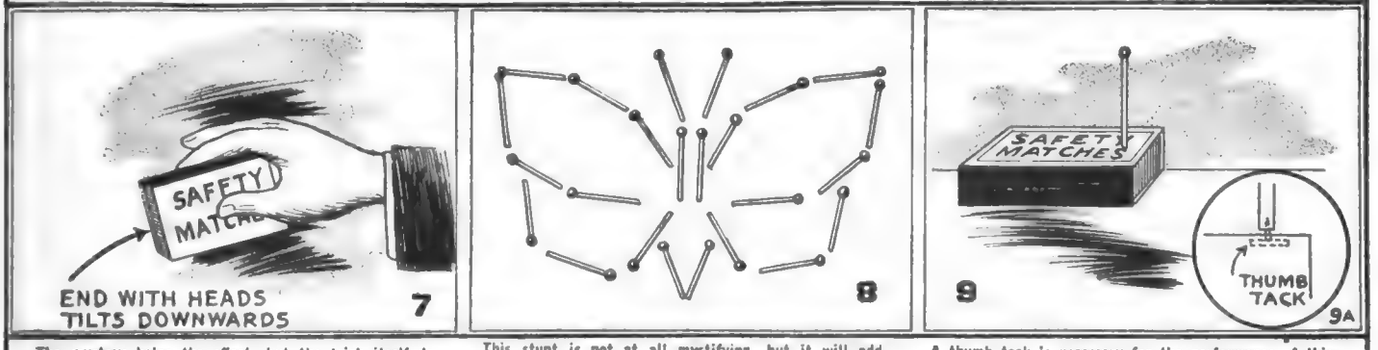
This stunt, shown above, is a simple variation of the one shown in the first two illustrations, except that the sanded edge of the box is used instead of its back, and the box is supported from the coat sleeves instead of the door. A box of non-safety matches with a sanded side is required in this stunt.



Hurl a box of safety matches in the air. It lands on the table with the label side up. Repeat the whirl two or three times. The box always falls flat, label side up. The box may be whirled by someone else, and in spite of anything they do, if they actually throw the box into the air, the results will be the same.

The secret of the trick just described lies in an old, old law. It is performed by virtue of a heavy coin placed in the bottom of the box between the drawer and the case. Preferably a heavy coin should be used. The weight of the coin causes the bottom of the box to fall downward.

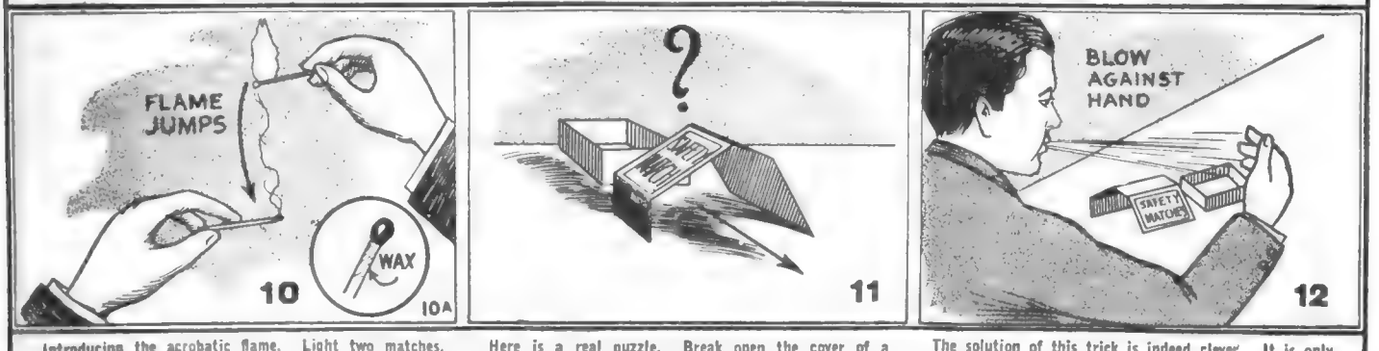
Borrow a box of safety matches from a friend, shuffle it in the hand, be very mysterious, and then tell which way the heads of the matches are pointing. Your results will be much more certain if the box of matches is a full one, since the difference in the weight of head end and tail end performs the trick.



The mystery helps the effect, but the trick itself depends entirely upon the good old law of gravitation. By grasping the box in the center very lightly the added weight of the heads of the matches will force one end of the box lower than the other, thus giving an indication of the direction of the heads.

This stunt is not at all mystifying, but it will add greatly to any impromptu entertainment. Simply take a handful of small safety matches and lay them out on the table in some preconceived design. If the design is viewed through half closed eyes from some distance, its effect will be surprising.

A thumb tack is necessary for the performance of this stunt. It is thrust part way through the cover of a match box as illustrated and a match is made to stand upright after the performer has made a lot of stage business seeking to lead his audience to believe that he is having trouble balancing the match on the box.



Introducing the acrobatic flame. Light two matches, blow one out and as the smoke curls up, hold the flame of the other match above it. Suddenly the flame slides down the curl of smoke and relights the lower match. The lower match must be previously coated with paraffine as an ordinary match will not work.

Here is a real puzzle. Break open the cover of a match box and set it so that it forms a sort of tunnel. Place the empty drawer of the box on the opposite side of the cover and then ask one of the audience to bring the drawer through the tunnel without touching it. The tunnel stands between him and the drawer.

The solution of this trick is indeed clever. It is only necessary for the performer to cup his hand in such fashion that it will reflect a stiff breath of air onto the drawer. By this means the wind will act against the drawer forcing it through the tunnel. With a slight amount of practice this may be done with ease.

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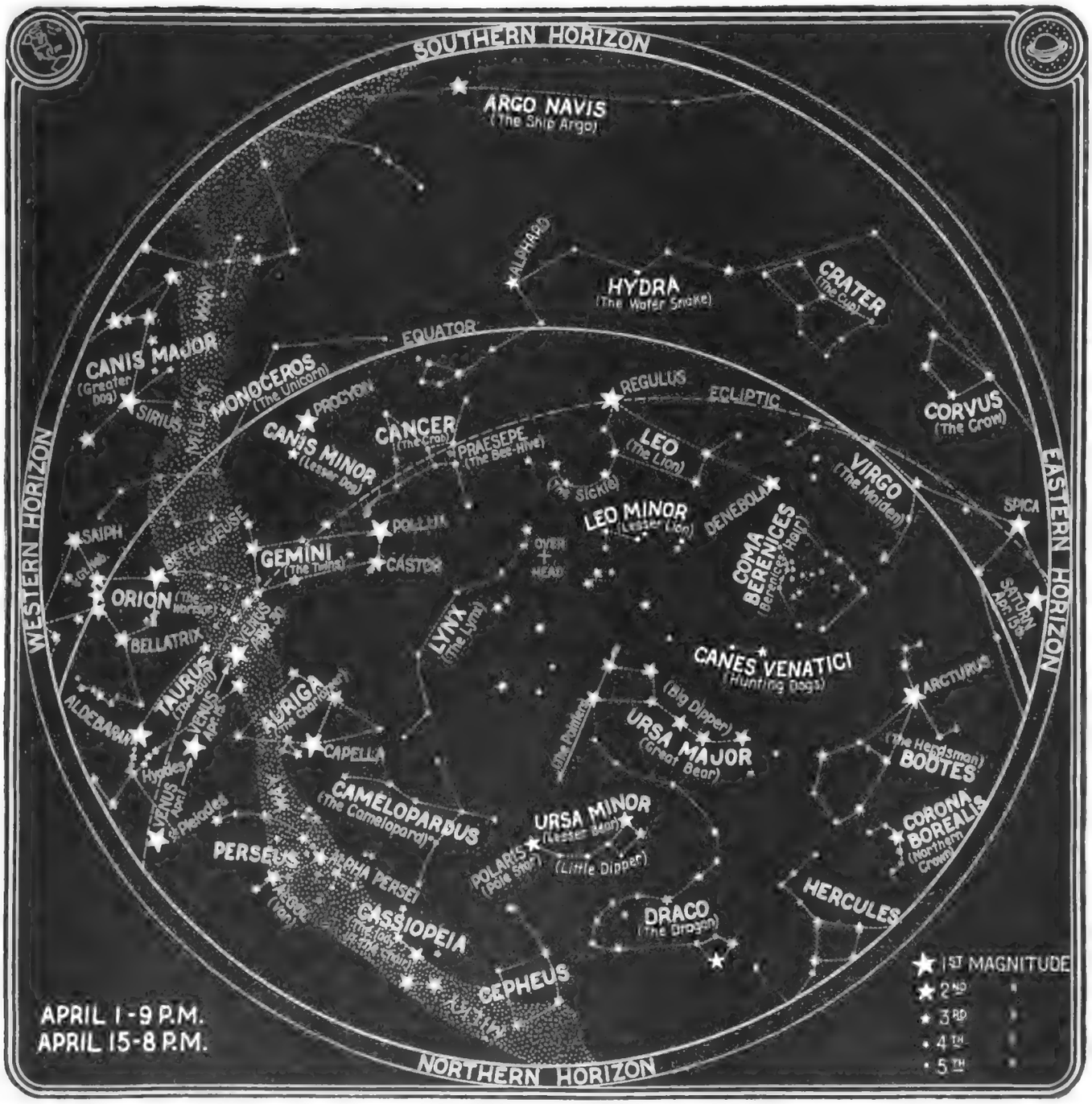
The Heavens in April

By ISABEL M. LEWIS, M.A.
of the U. S. Naval Observatory



Above is the star map for the month of April. If the chart is held over the head with the "Northern Horizon," north, at nine P. M., April first or eight P. M., April fifteenth the location of the stars in the heavens will coincide with their position on the map and may easily be found. Saturn is visible April fifteenth.

BY the first of April at nine o'clock in the evening the constellations that we associate with the spring months are well above the eastern horizon and the constellations of winter are fast disappearing from view in the west. Perseus, Taurus and Orion are on or close to the western horizon. Sirius, The Dog-Star, is low in the southwest, Capella in Auriga, in the northwest. Castor and Pollux, in Gemini, and Procyon in Canis Minor, The Lesser Dog, are still high in the western sky. [illegible] will be the last of the winter group to appear. The Milky Way, a broad band of faint light from Argo Navis on the southwestern horizon to Cepheus now at the north point of the horizon, is inclined to the western horizon at a low angle and is no longer seen at its best.

Facing due south we see the extensive constellation of Hydra stretching from a point south of Cancer, where a small group of faint stars mark the head, to the southeastern horizon, a distance of considerably more than ninety degrees. In the southeast, directly above Hydra, are the two small constellations of Crater, The Cup, and Corvus, The Crow, known as the riders of Hydra. They contain no stars brighter than the third magnitude. Diphda, or Cor Hydrae, the brightest star in Hydra and a star of the second magnitude stands very much alone and a little to the west of the meridian at this time.

THE BIG DIPPER

Turning to the northern heavens we find that Cepheus and Cassiopeia, two circumpolar groups that were conspicuously in view during the fall and winter months, are now close to the northern horizon and are no longer seen to advantage. Their places have been taken by the familiar Big Dipper in the

(*Continued on page* 1258)

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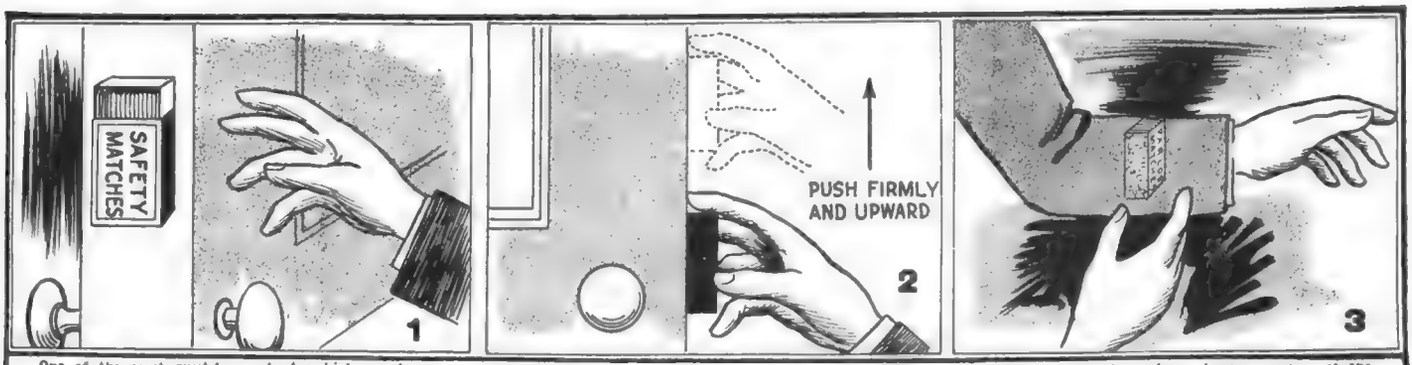

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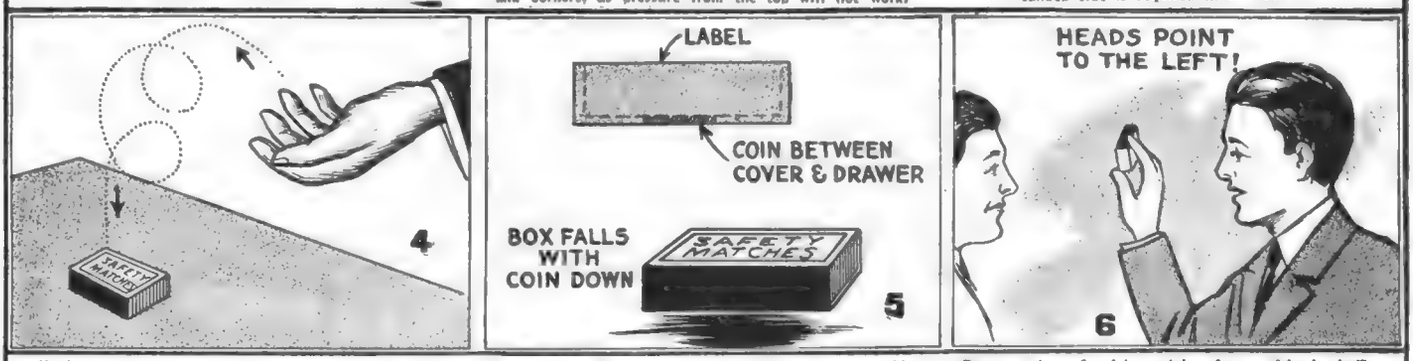

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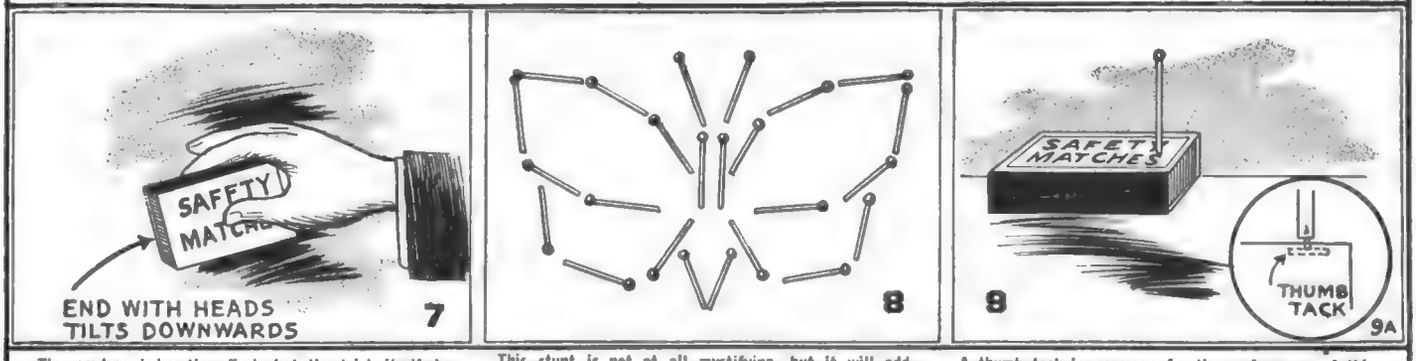

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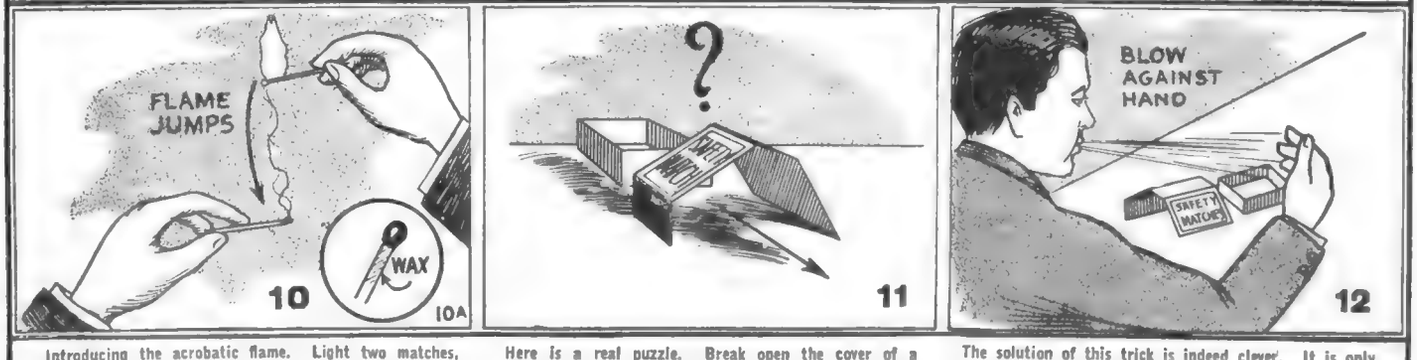

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Nature Effects in the Theatre

Suggestions of Use to Amateur Theatricals

By L. B. ROBBINS

Snow bag for falling snow
Torn white paper
Stop
Cloth
Slit
We are all familiar with the sight of torn bits of paper falling from above the stage in an attempt to simulate a snowfall. Usually unless the scheme shown in the upper left corner is followed, the results are rather poor. The bits of paper either come down in bunches or the effect is spoiled in some other way. However, if a large slotted sheet is hung above the stage, as illustrated, the torn paper may be sifted out slowly. This gives rise to an exceedingly effective and natural result, which cannot be obtained by any other simpler method.
Wind drum
Weight
Silk tied here
Wooden box
Showing peas or shot in bottom
How effect of pelting rain is produced
An effective wind machine which depends upon the property of silk to squeak when rubbed may be made by following the suggestion given in the upper right corner. A weight holds the silk taut. By constructing a square wooden box and before nailing it up, placing in it a quantity of dried peas or shot, the effect of pelting rain may be produced. A sheet of thin iron suspended from a suitable support may be used to imitate thunder if it is grasped at the bottom and shaken violently. Artificial lightning may be made with an arc light, or by means of a photographer's magnesium flashlight.
Thunder sheet
Sheet iron
Arc
Magnesium flash
Falling buildings-trees-etc
If an elaborate stage setting depicting an earthquake or other catastrophe wherein buildings are to be shattered is to be used, the noise accompanying such destruction can be furnished by means of a drum made as shown at the left, against which rest several wooden slats. These strips are to be held under tension so that as the drum is revolved they will be forcibly thrown across the cross members of the drum.
Sprung wood slats
Imitating water falls-rapids & cascades
Scenery
Canvas painted to imitate water
Waves
Stage
Bucket of rock salt
The effect of water falling over rocks in the form of a cascade or waterfall can be quite faithfully imitated by constructing an apparatus shown above at the right. Here three or more drums are used, over which the canvas is rolled by hand. This canvas is painted so as to give the appearance of water and the apparatus is concealed behind scenery, merely allowing the painted portion of the canvas to show through. The effect of waves breaking on a rock-bound shore can be produced by the use of painted scenery and one stage hand, as shown at the left. The assistant is located below the point where the waves are to break and periodically throws a few handsful of salt up. Two halves of cocoanut shells correctly manipulated on a stone slab give an excellent imitation of a galloping horse.
Half cocoanut shell
Illusion of galloping horse.
Stone slab
A. Stahle.

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A Bald Head Wig

Easily Constructed Home-Made Wig

CUT CROWN OF OLD DERBY HAT FROM BRIM

FORCE ON HEAD TO LOCATE PLACE TO CUT

PAINTED FLESH COLOR

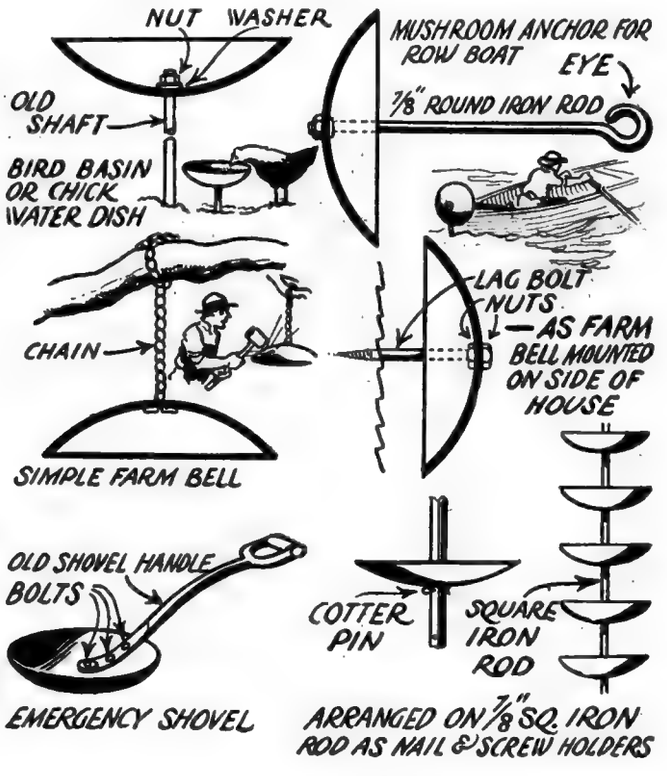
RIP OLD HAIR STUFFED CUSHION AND SEW HAIR TO PAINTED FOUNDATION WHERE DESIRED

FINISHED WIG IN USE

An exceedingly simple yet effective wig for amateur theatricals giving the effect of a bald head may be readily made by following the illustrations above. First cut the crown from an old derby hat and shape it as shown. Then paint it flesh color and from an old cushion obtain a quantity of hair. This hair can then be sewed around the base of the wig or fastened in place by means of glue. —Charles T. Alten.

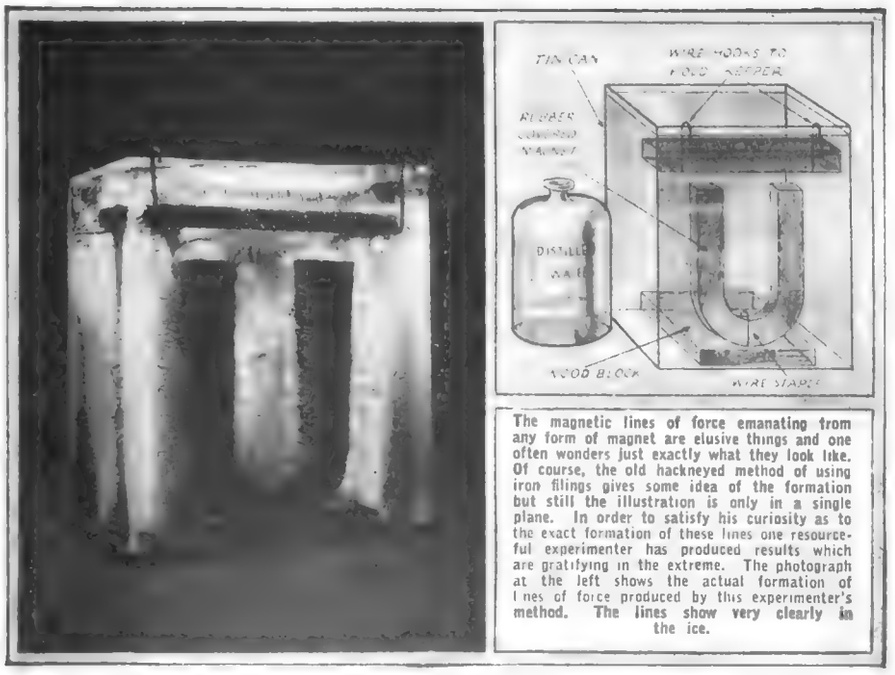
Uses for Harrow Discs

Articles Made from Discarded Discs



When the discs on the farm harrow become dull they are thrown away. However, they can very readily be put to numerous uses which will render them serviceable. Several suggestions are given above. The discs are in most cases used in their original form without drilling extra holes. In the case of the shovel, some drilling has to be done to accommodate the handle. —L. B. Robbins.

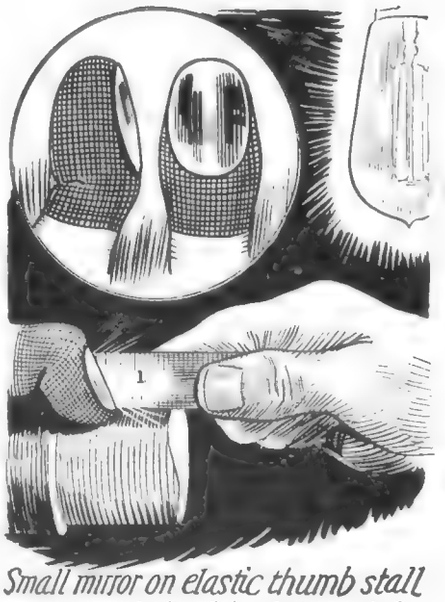
Magnetic Lines Illustrated



The magnetic lines of force emanating from any form of magnet are elusive things and one often wonders just exactly what they look like. Of course, the old hackneyed method of using iron filings gives some idea of the formation but still the illustration is only in a single plane. In order to satisfy his curiosity as to the exact formation of these lines one resourceful experimenter has produced results which are gratifying in the extreme. The photograph at the left shows the actual formation of lines of force produced by this experimenter's method. The lines show very clearly in the ice.

In order to reproduce the results shown in the photograph above, obtain a fairly large tin can. In the bottom of this can place a permanent magnet in an upright position secured by means of a staple to a wooden block. Place the magnet's keeper as shown, fill the can with water and allow to freeze. The stresses caused possibly by difference of expansion give an idea of so-called lines of force. —Clarence Ray.

Nail Reflector



Small mirror on elastic thumb stall worn on left thumb to catch and reflect light on scales in dark or shadowed places

When measuring various castings or articles to be shaped on shop machines, there is not always sufficient light directly on the rule or scale to provide easy reading. By wearing a thumb stall with a mirror attached on the left thumb, light may be reflected on the scale. —T...

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Silhouette Shadow Pictures

Method for Making Shadow Pictures from Photos

PHOTO
PAINT IN BLACKS
PLACE TRANSPARENT SHEET OVER, AND CUT OUT WHITES
BLACK MUST BE CONNECTED
HOLD UP TO LIGHT
PASTE ON WHITE SHEET

SHADOW photographs that will make the person pictured stand out beautifully can be made by taking a regular photograph, painting the dark portions a solid black and then, with the aid of a very fine pen knife, cutting the white portions away. As shown in the above sketches, the blacks are painted in in order to give the lines upon which the cuts are to be made. If the whole head is to stand out as in a profile view with dark background it will be necessary to cut a fine line around the border of the hair. After the cut-outs are made a white sheet is placed over the front of it and the whole placed where the light may shine through it. Although the scheme works very well if the cut-outs are made of regular writing paper results will be found to be more satisfactory if they are made from light cardboard as this will make the contrast more clear. The same process may be pursued with a pencil drawing although it will take a little practice on the part of the layman to discover just where the light and shadows will fall. It will be found necessary to use a very fine pen knife in the operations in order that the paper used may not tear. It is not necessary to demolish a good photograph in making the pictures since a tracing may be taken off the original and substituted with the same effect as cutting the original photo.

—A. Gruntal.

Weeping Fish

NOT that weeping fish appear in the annals of natural history. Not quite! At least, they do not appear outside the accounts of Jules Verne or the Baron Munchhausen. But that is no reason why they may not be made. Carve the fish or crocodile out of wood and weight him with shot or small lead slugs so that he will swim instead of float. Then color the body to look like the original. Then bore a small hole through the pupils of the eyes clear through the body. This done, fill the small hole with crushed water color or other pigment that will dissolve in water. Thrust a small piece of gauze or duck in each end of the hole to keep the color in. When the fish is placed in water the most beautiful streams of tears will come from the eyes and float gently to the bottom of the water.

—Dr. Albert Neuburger.

Bicycle Kink

If bicycle touring with a friend and you suffer a mishap with the front wheel why not simply remove the wheel and set the fork over the back axle of the friend's bicycle in the manner shown, forming a tandem?

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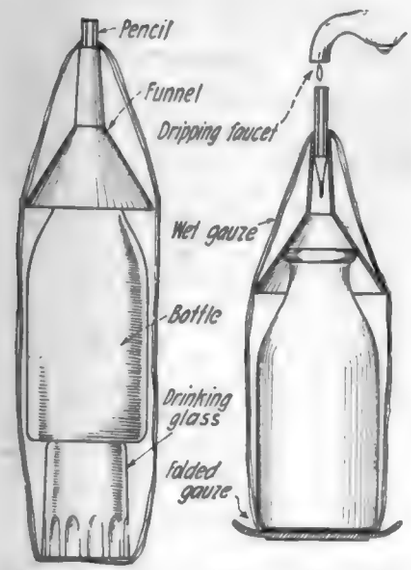
HOW-TO-MAKE-IT

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded, for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Cooler

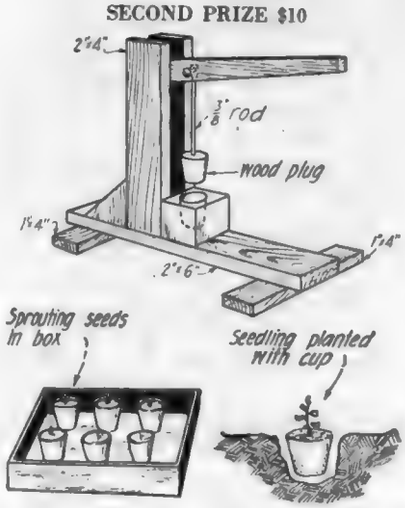
FIRST PRIZE $15



By placing a funnel over a bottle to be cooled, setting the bottle on a tumbler, tying the arrangement together with gauze and allowing water from an ordinary cold water faucet to drip slowly over it, as shown, evaporation will keep the contents of the bottle quite cold.
—J. M. Kendall.

Plant Cups

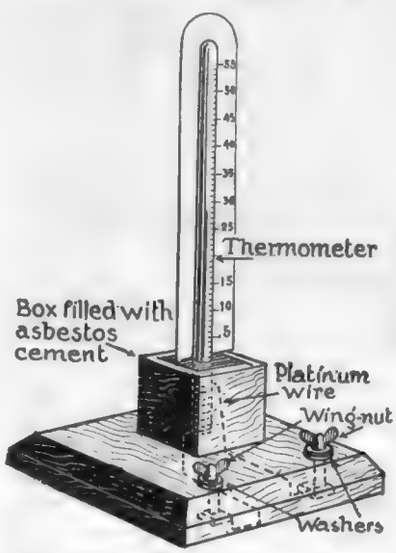
SECOND PRIZE $10



For the early spring gardener the above kink will be found exceptionally useful. Such plants as tomatoes and cabbages which have to be reset, are often retarded in their growth by such resetting. If cups are made of ordinary newspaper print paper with the aid of the form illustrated above, and the seeds of the plant sprouted in the cups, the gardener will be well repaid for his work in constructing the form by the advanced growth of the plant. The block and the plug used to form the cups may be made in any dimensions desirable. Two or three different sized blocks may be used in the same press.
—Dale R. Van Horn.

Ammeter

THIRD PRIZE $5



A novel comparative ammeter is illustrated above. It consists of nothing more than a thermometer around whose bulb have been wound a few turns of resistance wire. The bulb and wire are then embedded in a small square container which is filled with asbestos cement. The rise in the thermometer will be directly proportional to the current passed through the resistance.
—Simon Cherry.

Microtone

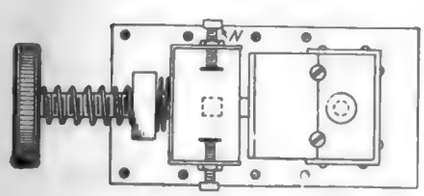


Fig. 2

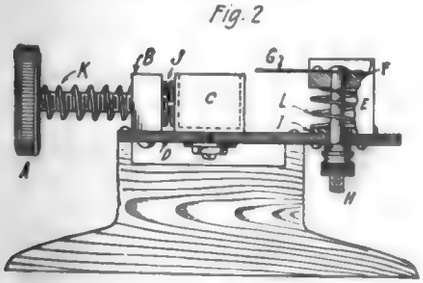


Fig. 1

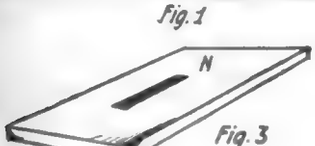
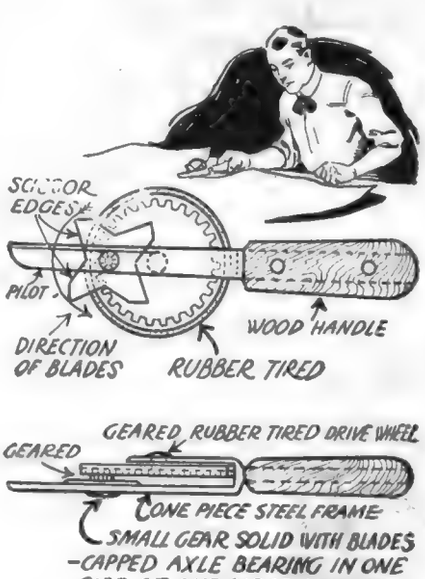


Fig. 3

Many experimenters using a microscope will at once see the value of the microtone shown above for slicing specimens. The thickness of the cut is regulated by nut H, which adjusts the height of the safety razor blade G. Specimen is imbedded in wax and held in the cup C.
—E. H. Swanson.

Scissors



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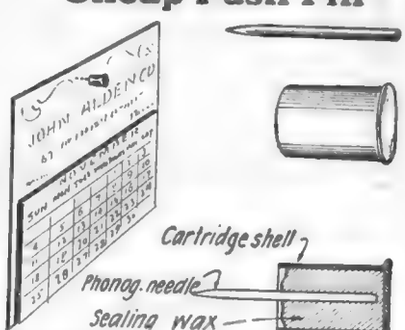
—Thomas H. Duffy.

Cheap Push Pin



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Artificial Cigar

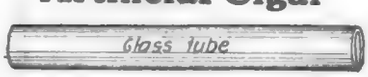

Fig. 1

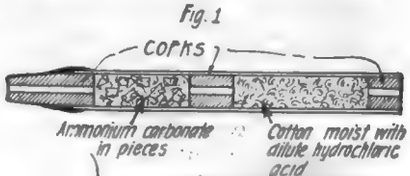

Fig 2

By covering a glass tube with cigar [illegible] corks and chemicals as shown, a [illegible] is made.

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Silhouette Shadow Pictures

Method for Making Shadow Pictures from Photos

PHOTO
PAINT IN BLACKS
PLACE TRANSPARENT SHEET OVER, AND CUT OUT WHITES
BLACK MUST BE CONNECTED
HOLD UP TO LIGHT
PASTE ON WHITE SHEET

SHADOW photographs that will make the person pictured stand out beautifully can be made by taking a regular photograph, painting the dark portions a solid black and then, with the aid of a very fine pen knife, cutting the white portions away. As shown in the above sketches, the blacks are painted in in order to give the lines upon which the cuts are to be made. If the whole head is to stand out as in a profile view with dark background it will be necessary to cut a fine line around the border of the hair. After the cut-outs are made a white sheet is placed over the front of it and the whole placed where the light may shine through it. Although the scheme works very well if the cut-outs are made of regular writing paper results will be found to be more satisfactory if they are made from light cardboard as this will make the contrast more clear. The same process may be pursued with a pencil drawing although it will take a little practice on the part of the layman to discover just where the light and shadows will fall. It will be found necessary to use a very fine pen knife in the operations in order that the paper used may not tear. It is not necessary to demolish a good photograph in making the pictures since a tracing may be taken off the original and substituted with the same effect as cutting the original photo. —A. Gruntal.

Weeping Fish

NOT that weeping fish appear in the annals of natural history. Not quite! At least, they do not appear outside the accounts of Jules Verne or the Baron Munchhausen. But that is no reason why they may not be made. Carve the fish or crocodile out of wood and weight him with shot or small lead slugs so that he will swim instead of float. Then color the body to look like the original. Then bore a small hole through the pupils of the eyes clear through the body. This done, fill the small hole with crushed water color or other pigment that will dissolve in water. Thrust a small piece of gauze or duck in each end of the hole to keep the color in. When the fish is placed in water the most beautiful streams of tears will come from the eyes and float gently to the bottom of the water.

—Dr. Albert Neuburger.

Bicycle Kink

If bicycle touring with a friend and you suffer a mishap with the front wheel why not simply remove the wheel and set the fork over the back axle of the friend's bicycle in the manner shown, forming a tandem?

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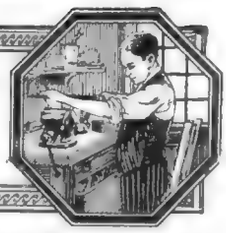
HOW-TO-MAKE-IT

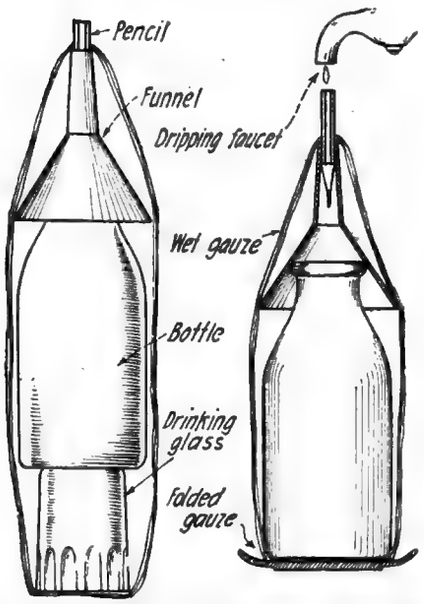


This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.

The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded, for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Cooler

FIRST PRIZE $15

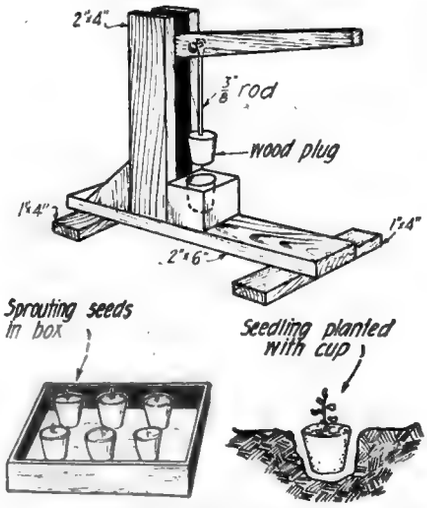


By placing a funnel over a bottle to be cooled, setting the bottle on a tumbler, tying the arrangement together with gauze and allowing water from an ordinary cold water faucet to drip slowly over it, as shown, evaporation will keep the contents of the bottle quite cold.

—J. M. Kendall.

Plant Cups

SECOND PRIZE $10

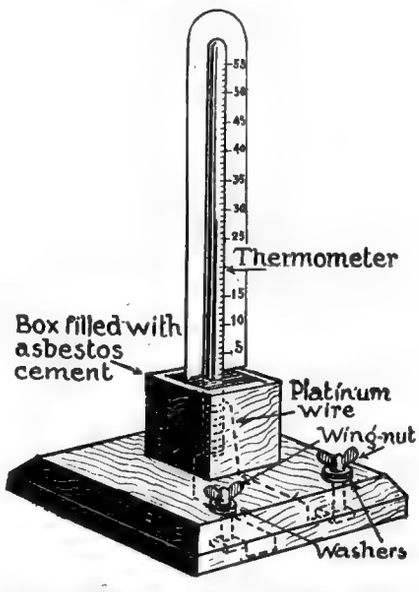


For the early spring gardener the above kink will be found exceptionally useful. Such plants as tomatoes and cabbages which have to be reset, are often retarded in their growth by such resetting. If cups are made of ordinary newspaper print paper with the aid of the form illustrated above, and the seeds of the plant sprouted in the cups, the gardener will be well repaid for his work in constructing the form by the advanced growth of the plant. The block and the plug used to form the cups may be made in any dimensions desirable. Two or three different sized blocks may be used in the same press.

—Dale R. Van Horn.

Ammeter

THIRD PRIZE $5



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—Simon Cherry.

Microtone

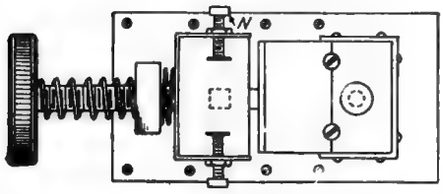

Fig. 2

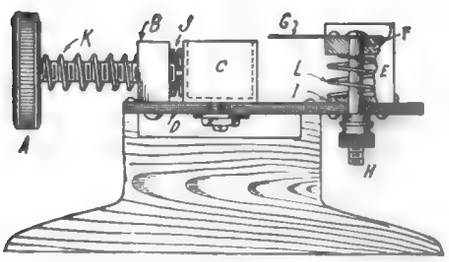

Fig. 1

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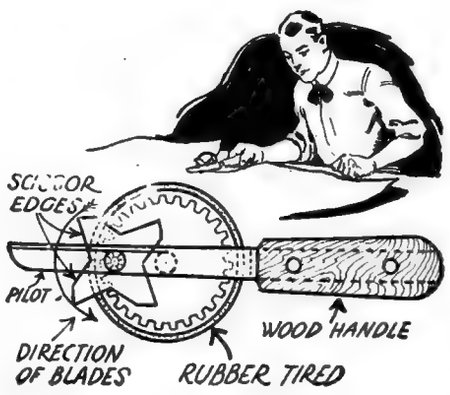
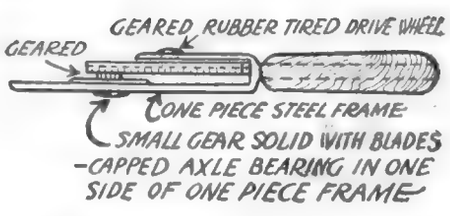
Scissors

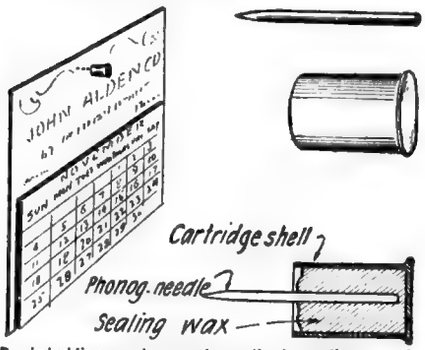



GEARED RUBBER TIRED DRIVE WHEEL
GEARED
ONE PIECE STEEL FRAME
SMALL GEAR SOLID WITH BLADES
CAPPED AXLE BEARING IN ONE SIDE OF ONE PIECE FRAME

From those who do a great deal of cutting, the mechanical scissors illustrated above, will find a happy reception. The rotating blades are geared to the large wheel which has a rubber tire and is fixed to the handle of the machine which is made of an old scissor's blade. As the wheel runs along the counter or table, the blades revolve cutting the heaviest cloth. The fixed blade acts as a guide, feeding the cloth to the rotating blades.

—Thomas H. Duffy.

Cheap Push Pin



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Artificial Cigar

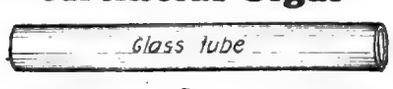

Fig. 1

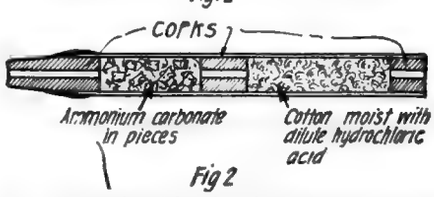

Fig 2

By covering a glass tube with cigar wrapper and using corks and chemicals as shown, a harmless artificial cigar is made.

—S. Marchese.

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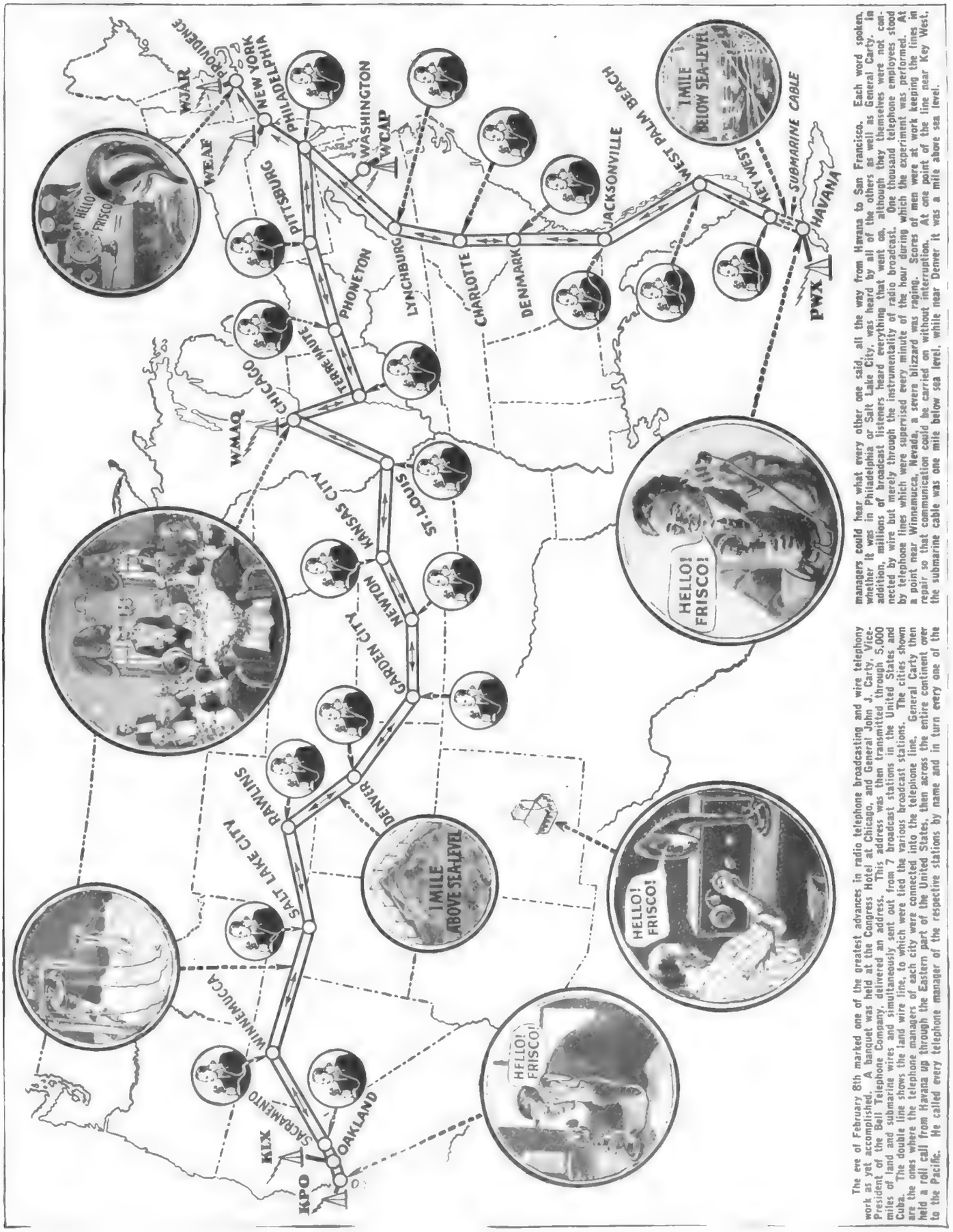
Simultaneous Broadcasting

Cuba and San Francisco Linked by Radio and Telephone



The eve of February 8th marked one of the greatest advances in radio telephone broadcasting and wire telephony work as yet accomplished. A banquet was held at the Congress Hotel at Chicago, and General John J. Carty, Vice-President of the Bell Telephone Company, delivered an address. This address was then transmitted through 5,000 miles of land and submarine wires and simultaneously sent out from 7 broadcast stations in the United States and Cuba. The double line shows the land wire line, to which were tied the various broadcast stations. The cities shown are the ones where the telephone managers of each city were connected into the telephone line. General Carty then held a roll call from Havana up through the Eastern part of the United States, then across the entire continent over to the Pacific. He called every telephone manager of the respective stations by name and in turn every one of the managers could hear what every other one said, all the way from Havana to San Francisco. Each word spoken, whether it was in Philadelphia or Salt Lake City, was heard by all of the others as well as General Carty. In addition, millions of broadcast listeners heard everything that went on, although they themselves were not connected by wire but merely through the instrumentality of radio broadcast. One thousand telephone employees stood by telephone lines which were supervised every minute of the hour during which the experiment was performed. At a point near Winnemucca, Nevada, a severe blizzard was raging. Scores of men were at work keeping the lines in repair so that communication could be carried on without interruption. At one point of the line near Key West, the submarine cable was one mile below sea level, while near Denver it was a mile above sea level.

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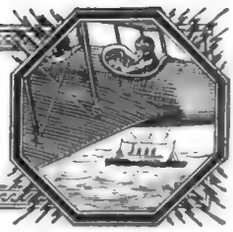
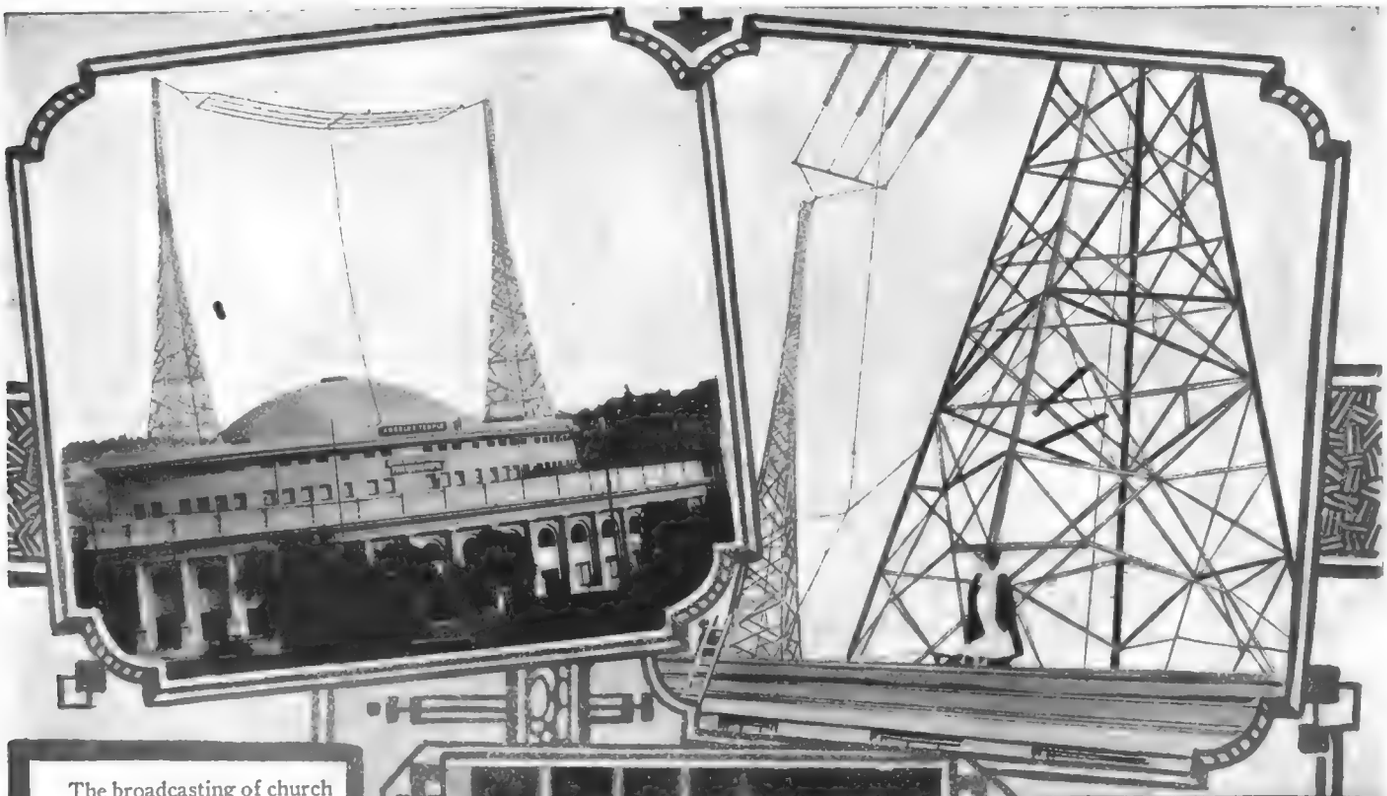
RADIO



A Radio Equipped Church

A Complete Broadcasting Station for Religious Work

BY J. F. ODENBACH *



The broadcasting of church services, sermons and hymns is by no means new to the radio public, but the actual installation of a complete and up-to-date broadcasting station in a church is somewhat of a novelty. However, Aimee Semple MacPherson, the woman evangelist known throughout the country, has just completed the installation of broadcasting apparatus in her Angelus Temple, Los Angeles, California, and will shortly begin broadcasting her sermons and the music of her choir for the express benefit of listeners-in. Miss MacPherson, in undertaking this work has not done any of it by halves, but has gone in to the erection of her radio station with an enthusiasm which assures it a complete success. Proof of this may be had by glancing at the two illustrations of the antenna installation at the top of this page and another at the voice amplifier and other apparatus shown in the illustration at the right. The photo shows Miss MacPherson at the microphone.

It is an undisputed fact that the introduction of radio broadcasting to the churches throughout this country has resulted in a greater interest being manifested in religion. Many people who formerly were not consistent church goers have become converted and every Sunday morning finds them at the radio set tuning in on the service of some nearby or far-away church. It is now possible to select your own sermon and if the one you happen to be listening to doesn't quite suit your desires, you only need to turn the dials and listen to some other station. Usually, however, up to this time the broadcasting has been done more or less spasmodically and little or no effort has been put forth to place broadcasting as an integral part of the church. Many churches have installed radio transmitters heretofore, but usually they were of very low power and most of them have been discontinued. This one is undoubtedly permanent.

* Reporter No. 10

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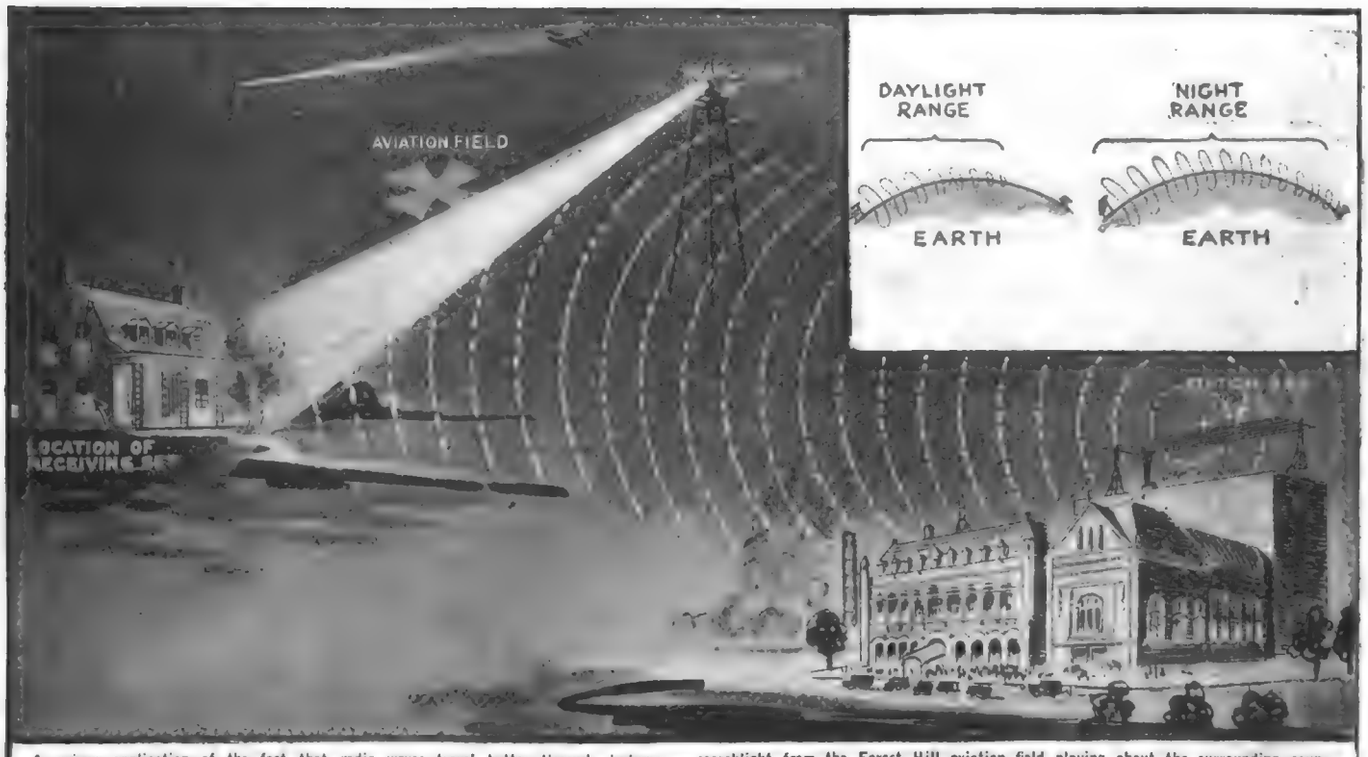
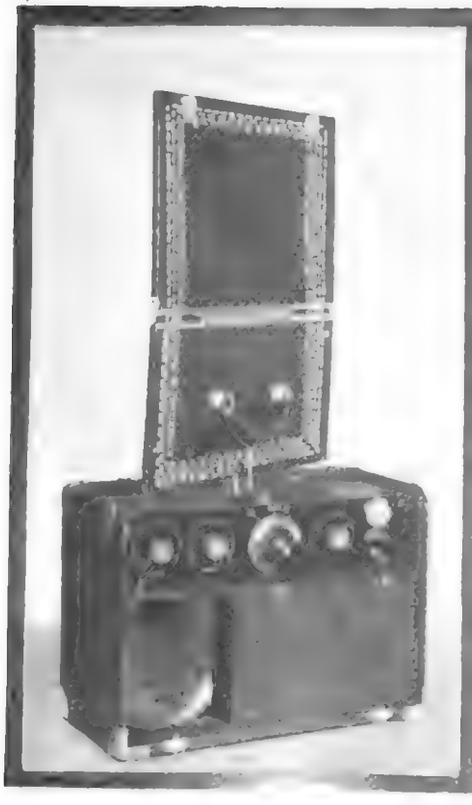
Searchlight Causes Fading



A unique application of the fact that radio waves travel better through darkness than through light was recently brought forth by an amateur radio fan of the Middle West. This amateur was located, as pictured above, some distance from broadcasting station KSD. He was operating a small crystal receiving set and one night noticed that the signals faded considerably. This happened at regular intervals and of course called for an investigation, as the weakness of reception seemed to differ somewhat from the usual fading due to atmospheric conditions. Looking out of the window, Mr. Louis Robin, the amateur who had noticed this peculiarity saw a searchlight from the Forest Hill aviation field playing about the surrounding countryside. Listening in on his receiving set to station KSD and watching the searchlight at the same time, he noticed that whenever the rays of the light were directed across a line passing between his antenna and the broadcasting station, the signal strength was reduced in a marked degree. The results noted seemed to be very much in accordance with former observations covering the difference between daytime and night reception. The difference in signal strength is probably due to the ionizing effect of light.

—C. Doville Walker, Reporter No. 577.

SELF-CONTAINED PORTABLE RECEIVER



A radio company of the Middle West has recently put on the market one of the most complete and compact self-contained receiving sets which has come to our attention in some time. Most of the portable sets which have been put out of late utilize only one or two or at the most three tubes. However, the manufacturers of this set, called the Operadio, have placed therein six vacuum tubes and use a circuit giving three stages of radio frequency amplification, a vacuum tube detector and two stages of audio frequency amplification. Thus a set capable of operating on a loop antenna and reproducing signals with sufficient strength to operate a loud speaker is obtained. The set is entirely self-contained, including both "A" and "B" batteries, the loop antenna and the loud talker.

One of the most novel features of this receiving set and one which to our knowledge has never been brought forth before is the location of the loop aerial. As will be noticed at the left, the loop antenna winding is entirely contained within two sections of the case which are hinged together and which when closed form the top and one side of the container or carrying case. A handle is fitted for quick and easy transportation and a plug is provided by means of which the antenna can be placed on the top of the apparatus when ready for use and at the same time connection is also made between the loop antenna and the receiving set. The completed set folded up is shown in the photograph at the right. The wire of the loop is indicated by dotted lines in the photograph at left.

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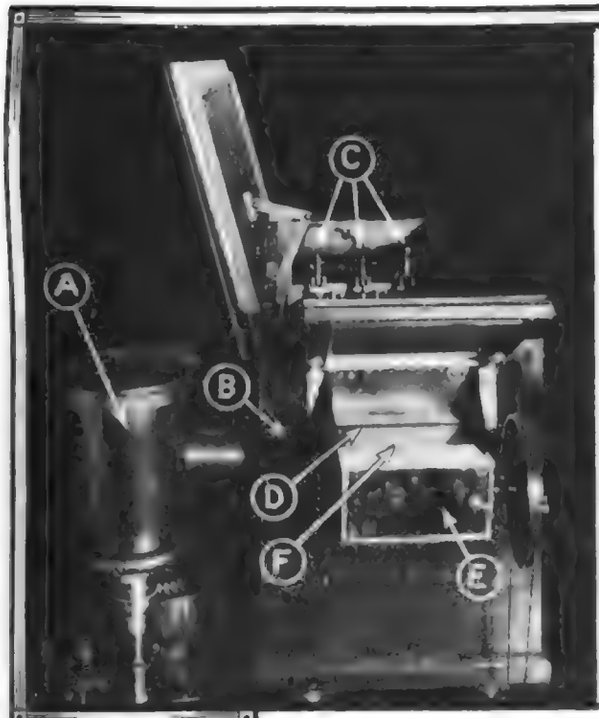
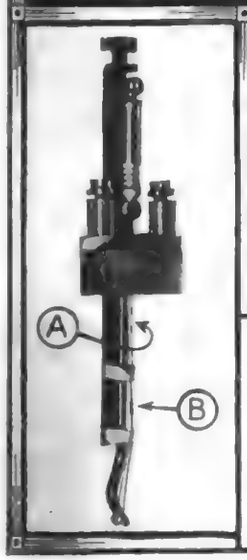
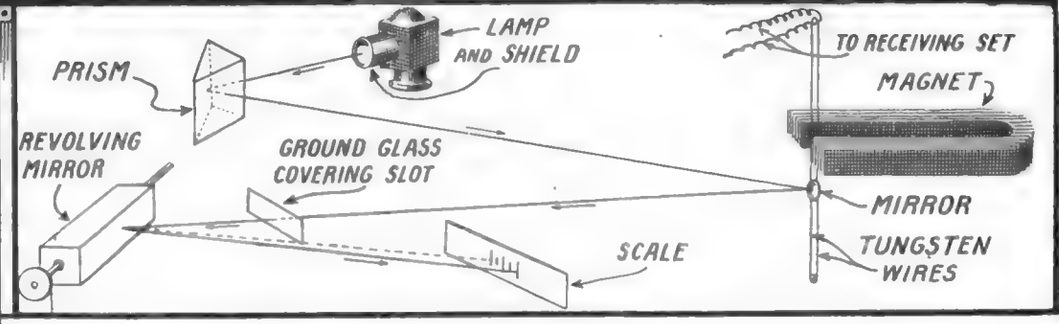
Your Voice Made Visible



At stations WJZ and WJY New York City there is in use a newly developed device for indicating in a visual manner the quantity of modulation being used in the outgoing antenna circuit. The instrument is built on the order of the standard oscillograph and it gives the operator in charge a very good check, not on the quality of modulation but on the quantity. The quality of the outgoing signals is determined by monitoring sets through which the signals are reproduced in exactly the same manner as they would be in receiving stations throughout the country. The entire instruments used for detecting the quantity of modulation is illustrated at the left. Here A indicates a lamp housing containing an electric light; B indicates the point at which a prism is located for bending the light rays; C, shows three sets of tungsten wires supporting small mirrors any one of which can be used when desired; D, points to the slit in the box through which the light from the lamp is reflected by the mirrors; E, shows a four sided revolving mirror which reflects upon the scale, the light coming through the slot. The light ray coming through the slot, D, moves backward and forward over the revolving mirror, whence it is reflected to the scale and an indication of the degree of the modulation is given.

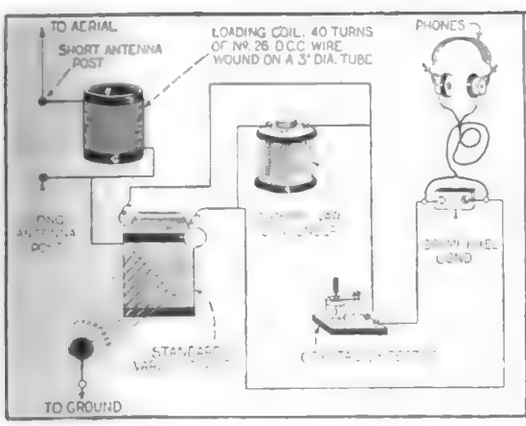
At the right is shown a photograph of the collector apparatus used in connection with the visual modulator shown at the left. In this photograph, A indicates the lead-in from the transmitting antenna passing through a pick-up coil B which in turn is connected to a standard radio receiving set indicated by C. Leads go from the latter to the device shown in the photograph at the left.





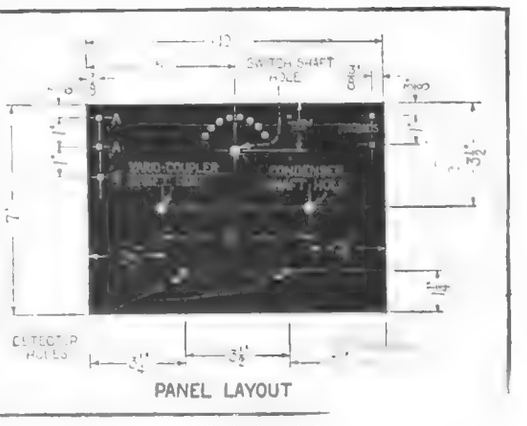
The photograph at the left shows a close-up view of the apparatus holding the reflecting and vibrating mirror which is used in the oscillograph shown in the upper left corner. At the left, A indicates two tungsten wires suspended and arranged with adjusting screws while B indicates a tiny mirror fastened to these two wires. The two wires pass through between the opposite poles of a permanent or an electro-magnet as the case may be. Current passing through the two tungsten wires from the receiving set cause them to twist in unison with the pulsation of the current received. Thus the mirror is made to vibrate and reflect the light beam. A diagrammatic view of the entire oscillograph is shown directly above. As will be noticed the light beam goes from the lamp to the prism, is bent or reflected toward the mirror where it is reflected through the ground glass upon the revolving mirror and back to the scale. The diagram is exaggerated in certain parts so as to make the action clearer.

Efficient Crystal Receiver



An extremely efficient crystal receiver using a vario-coupler and a variable condenser for the tuning has been designed by the writer and a circuit diagram of the same is shown at the left. A loading coil is included in the circuit and two binding posts provided so that when a short antenna is used the loading coil may be included in the circuit or it may be cut out when a long aerial is to be employed. Any type of standard vario-coupler may be used in this circuit, and it may have one or two switches on the stator. In the latter case, the lead from the antenna will go to the second switch arm. In order to make sharp tuning possible, a small variable condenser is connected across the rotor of the coupler. Any standard type crystal detector may be used.

—Gilbert Billin.



PANEL LAYOUT

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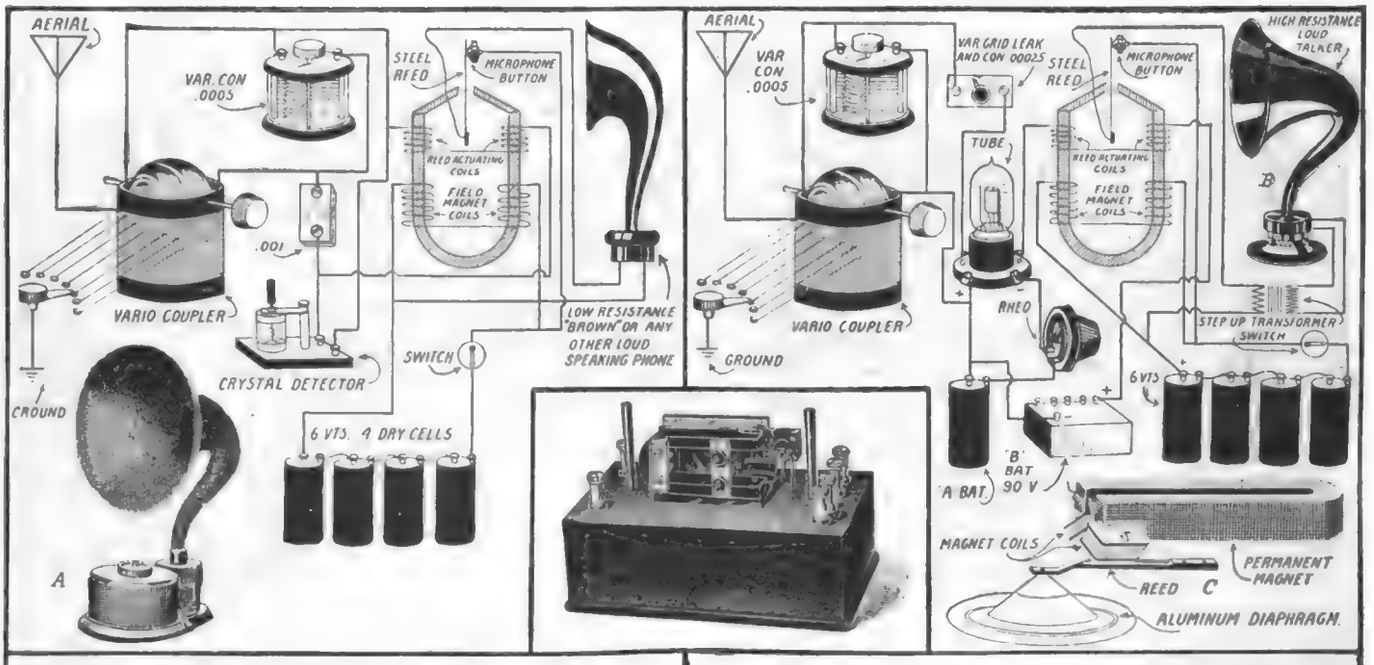
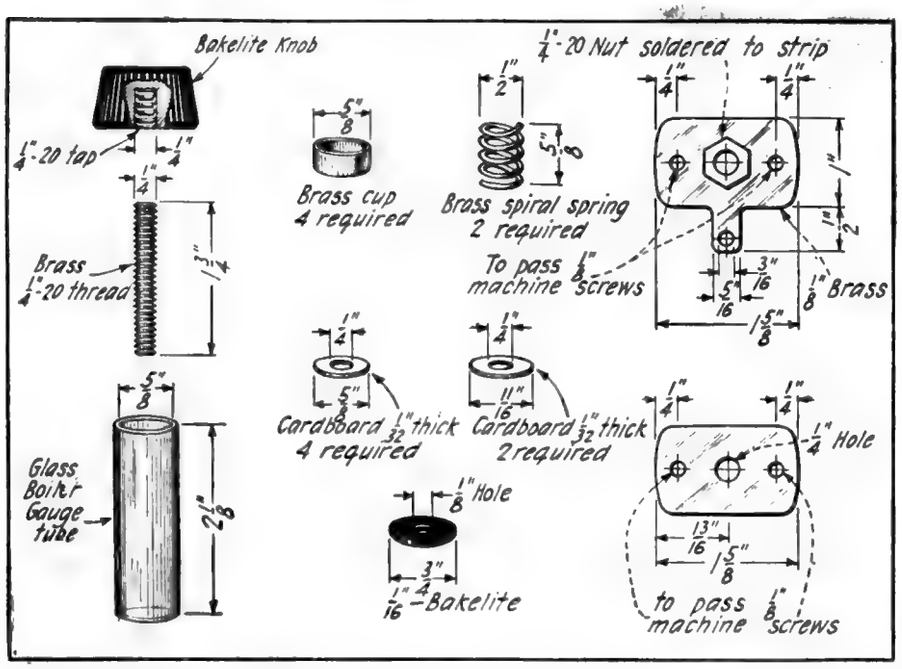
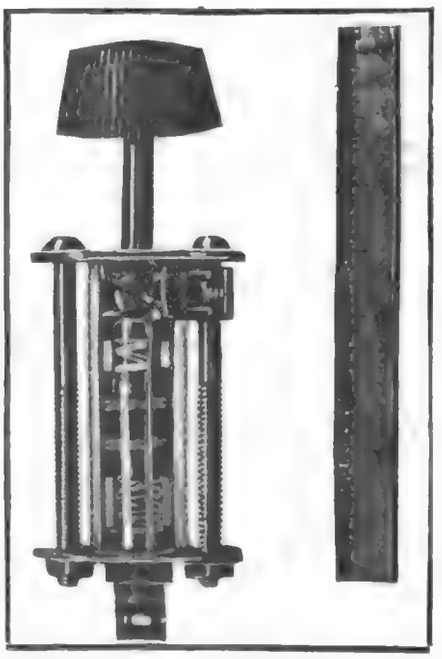
A Crystal Set Loud Talker



At last a device has been brought out by an English concern which sells for approximately the same price as a two-stage audio frequency amplifier and will allow the operation of a loud speaker with a crystal detector. Contrary to the standard two-stage amplifier, it has very little upkeep cost, it only being necessary to replace the four dry cells used, occasionally. Of course, this same amplifier can be used on a vacuum tube detector with a corresponding increase in receiving range and volume. Both of the circuit diagrams are shown above. This device operates on the principle of an electro-magnet actuating a steel reed. This reed in turn sets up vibrations in a microphone button, which cause a loud speaker to give forth sounds in accordance with the vibrations of the steel reed. On somewhat the same principle as the well-known Magnavox, the field magnets are energized by the dry cells and other coils are wound on the same magnets as shown for actuating the steel reeds. This microphone relay device is shown in unit form in the insert. At A in the lower left corner of the above illustration is shown the complete unit containing both a loud talker and the microphonic relay. At B is shown a new type of loud speaking receiver manufactured by the same company. The working mechanism of this instrument is shown at C in the lower righthand corner. An aluminum diaphragm in conical form is used, which gives excellent reproduction of received signals. In the loud speaking receiver shown at B the permanent magnet illustrated in C forms the base of the instrument and serves to support the magnet coils and the rest of the mechanism.

Compression Type Rheostat





In the operation of detector tubes, which are usually of the gaseous type, it is necessary to have a critical adjustment of the amount of current supplied to the filament. Even in the case of amplifiers it is sometimes advisable to have such a device. A rheostat capable of operating in this manner can readily be made by the amateur from the working drawing and the photograph shown above. The first requisite is a piece of glass boiler gauge tubing or fiber tubing 5/8 inch, inside diameter, by 2 1/8 inches long. Next, four brass cups 5/8 inch or slightly less in diameter by about 3/8 or 1/4 of an inch long. Six cardboard washers of the sizes indicated above should then be obtained and 1/4-inch holes cut in the center of each one. Bakelite discs of the dimension shown will also be necessary. A threaded brass rod and a knob to fit are then provided. Next, from 1/16-inch brass cut the two end pieces to the dimension shown and solder a nut in the center of one. The assembly is made as follows: Bolt one of the brass cups and a spring binding post to the bottom support, insulating the cup and the post from the brass strip. Place a spiral spring in the cup and invert another cup over the other end of the spring. Place the glass tubing over the assembly made thus far and pour in a quantity of granulated carbon or a mixture of granulated carbon and copper filings. Add two more cardboard discs and another cup. Insert the other spring and the fourth cup. Continue the assembly as shown in the photograph at the right above.

—Armstrong Perry.

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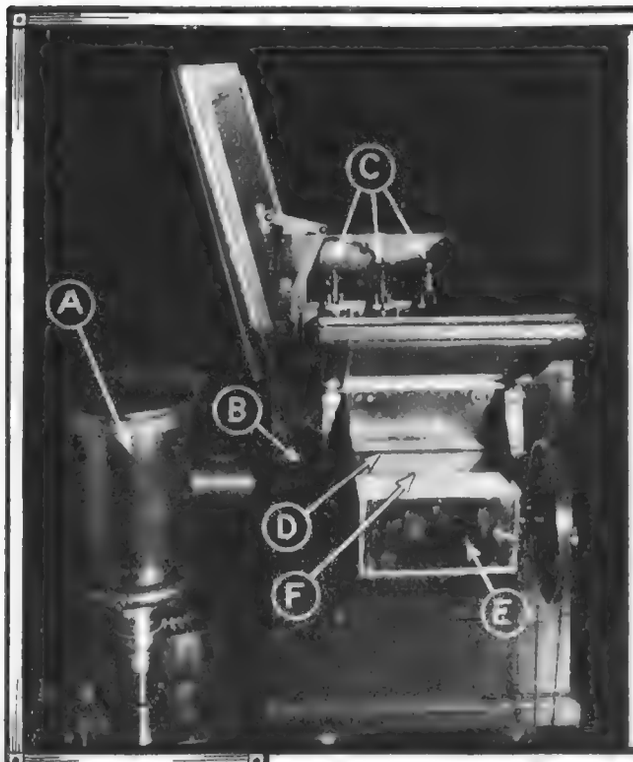
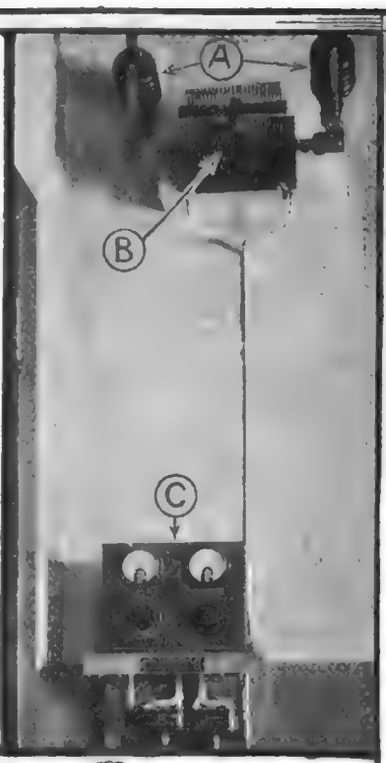
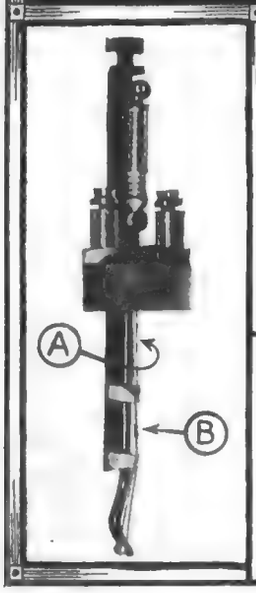
Your Voice Made Visible

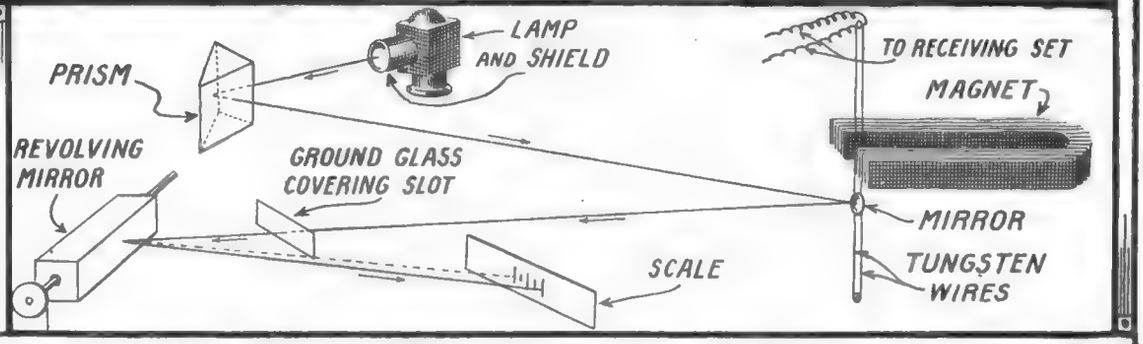


At stations WJZ and WJY New York City there is in use a newly developed device for indicating in a visual manner the quantity of modulation being used in the outgoing antenna circuit. The instrument is built on the order of the standard oscillograph and it gives the operator in charge a very good check, not on the quality of modulation but on the quantity. The quality of the outgoing signals is determined by monitoring sets through which the signals are reproduced in exactly the same manner as they would be in receiving stations throughout the country. The entire instruments used for detecting the quantity of modulation is illustrated at the left. Here A indicates a lamp housing containing an electric light; B indicates the point at which a prism is located for bending the light rays; C, shows three sets of tungsten wires supporting small mirrors any one of which can be used when desired; D, points to the slit in the box through which the light from the lamp is reflected by the mirrors; E, shows a four sided revolving mirror which reflects upon the scale, the light coming through the slot. The light ray coming through the slot, D, moves backward and forward over the revolving mirror, whence it is reflected to the scale and an indication of the degree of the modulation is given.

At the right is shown a photograph of the collector apparatus used in connection with the visual modulator shown at the left. In this photograph, A indicates the lead-in from the transmitting antenna passing through a pick-up coil B which in turn is connected to a standard radio receiving set indicated by C. Leads go from the latter to the device shown in the photograph at the left.

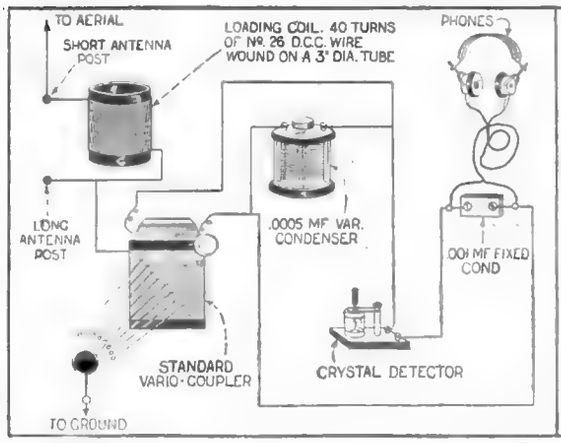






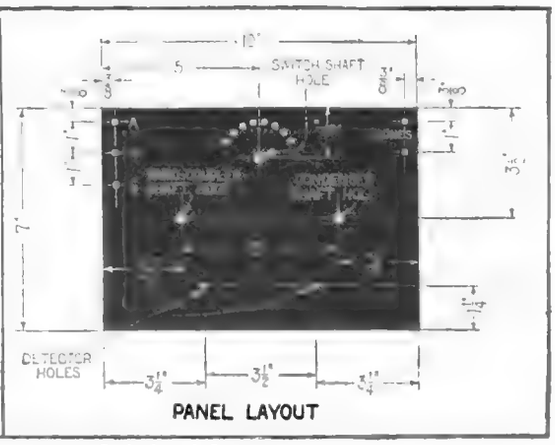
The photograph at the left shows a close-up view of the apparatus holding the reflecting and vibrating mirror which is used in the oscillograph shown in the upper left corner. At the left, A indicates two tungsten wires suspended and arranged with adjusting screws while B indicates a tiny mirror fastened to these two wires. The two wires pass through between the opposite poles of a permanent or an electro-magnet as the case may be. Current passing through the two tungsten wires from the receiving set cause them to twist in unison with the pulsation of the current received. Thus the mirror is made to vibrate and reflect the light beam. A diagrammatic view of the entire oscillograph is shown directly above. As will be noticed the light beam goes from the lamp to the prism, is bent or reflected toward the mirror where it is reflected through the ground glass upon the revolving mirror and back to the scale. The diagram is exaggerated in certain parts so as to make the action clearer.

Efficient Crystal Receiver



An extremely efficient crystal receiver using a vario-coupler and a variable condenser for the tuning has been designed by the writer and a circuit diagram of the same is shown at the left. A loading coil is included in the circuit and two binding posts provided so that when a short antenna is used the loading coil may be included in the circuit or it may be cut out when a long aerial is to be employed. Any type of standard vario-coupler may be used in this circuit, and it may have one or two switches on the stator. In the latter case, the lead from the antenna will go to the second switch arm. In order to make sharp tuning possible, a small variable condenser is connected across the rotor of the coupler. Any standard type crystal detector may be used.

—Gilbert Billin.



PANEL LAYOUT

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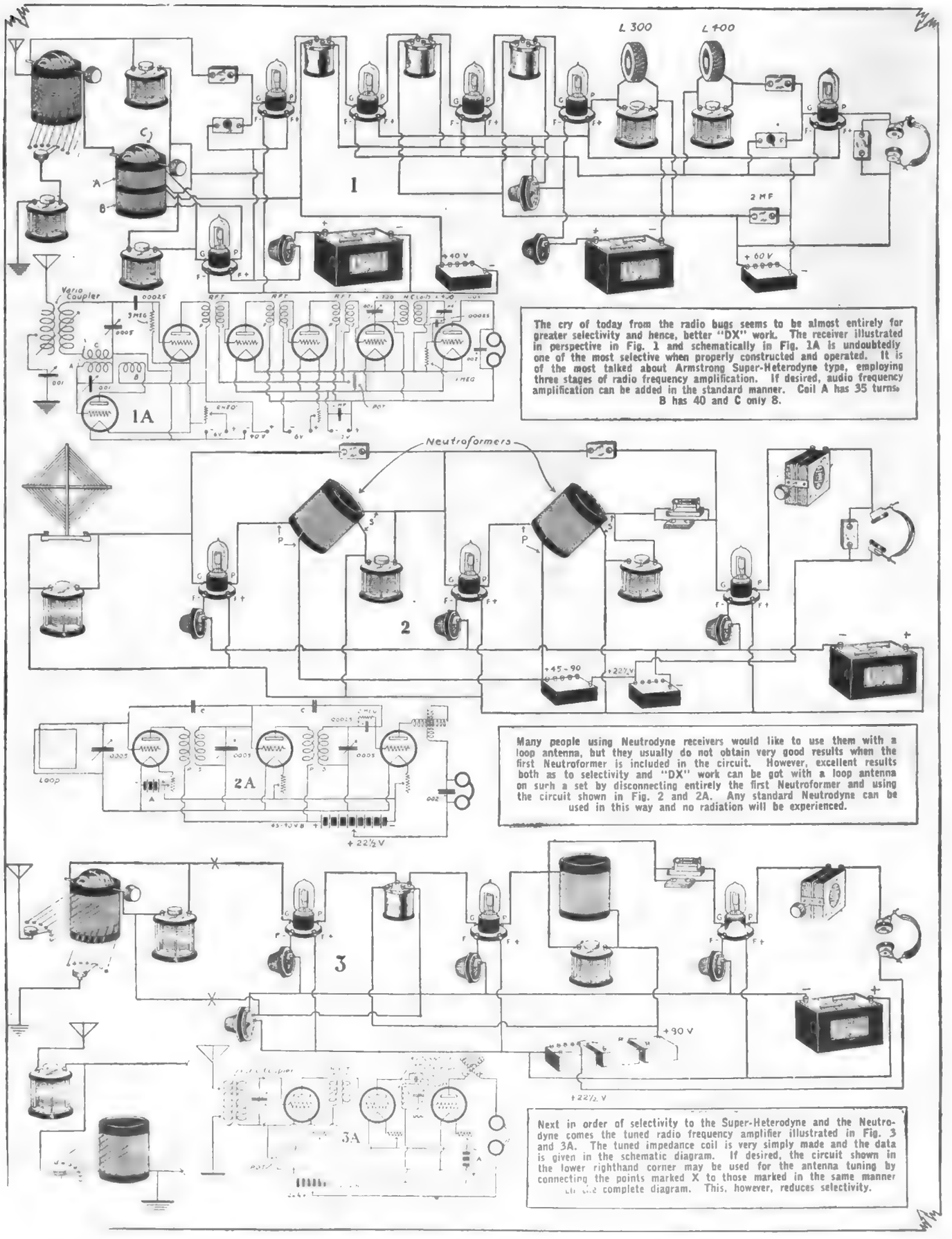
Selective Receivers--From

By A. P. PECK, Associate Member



The cry of today from the radio bugs seems to be almost entirely for greater selectivity and hence, better "DX" work. The receiver illustrated in perspective in Fig. 1 and schematically in Fig. 1A is undoubtedly one of the most selective when properly constructed and operated. It is of the most talked about Armstrong Super-Heterodyne type, employing three stages of radio frequency amplification. If desired, audio frequency amplification can be added in the standard manner. Coil A has 35 turns. B has 40 and C only 8.

Many people using Neutrodyne receivers would like to use them with a loop antenna, but they usually do not obtain very good results when the first Neutroformer is included in the circuit. However, excellent results both as to selectivity and "DX" work can be got with a loop antenna on such a set by disconnecting entirely the first Neutroformer and using the circuit shown in Fig. 2 and 2A. Any standard Neutrodyne can be used in this way and no radiation will be experienced.

Next in order of selectivity to the Super-Heterodyne and the Neutrodyne comes the tuned radio frequency amplifier illustrated in Fig. 3 and 3A. The tuned impedance coil is very simply made and the data is given in the schematic diagram. If desired, the circuit shown in the lower righthand corner may be used for the antenna tuning by connecting the points marked X to those marked in the same manner on the complete diagram. This, however, reduces selectivity.

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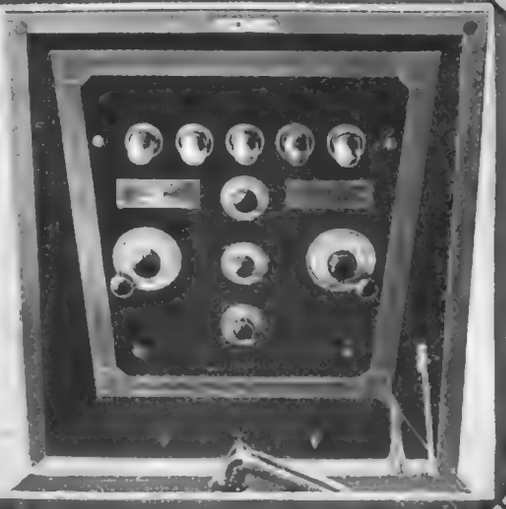
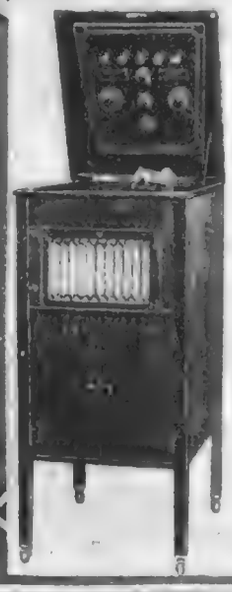
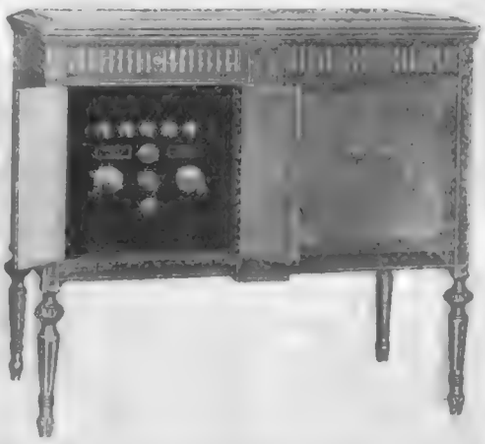
Radio Set and Phonograph Combinations

Complete Receiving Sets in Phonograph Cabinets



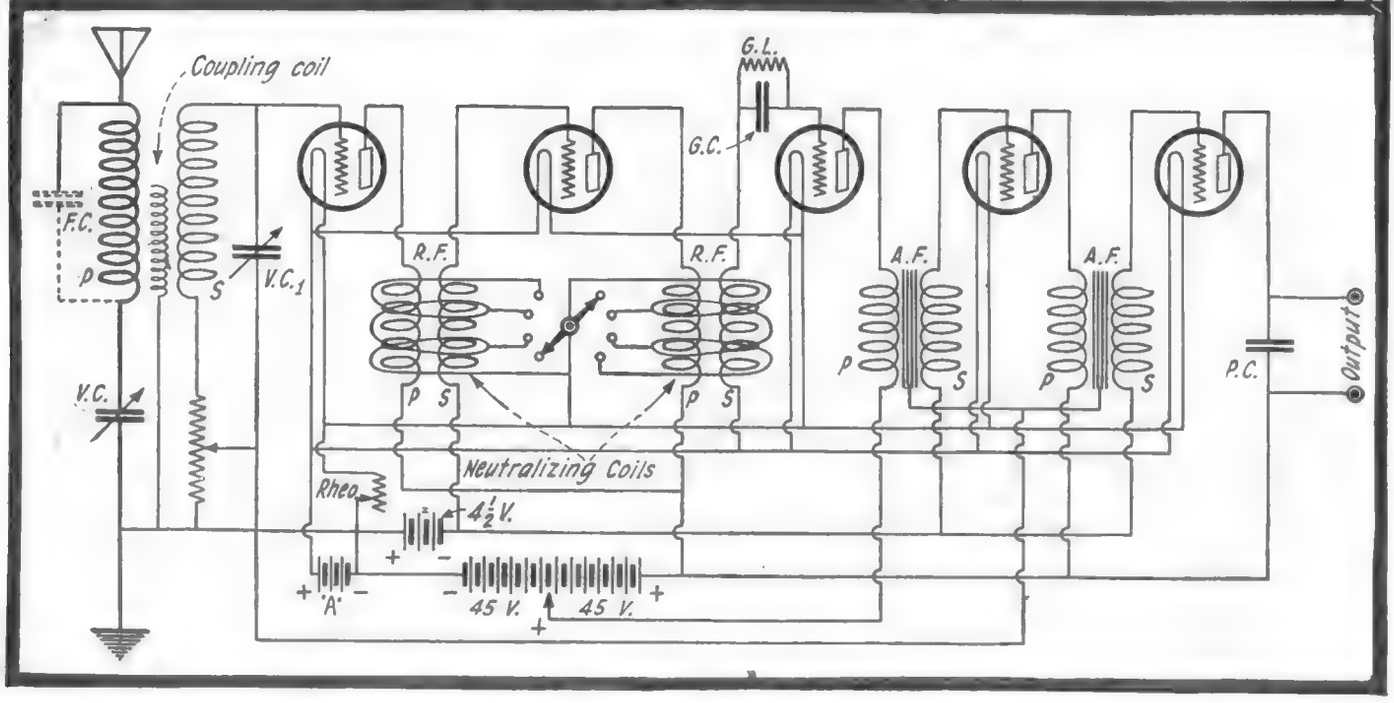




A radio receiving set especially designed to be placed in any one of several styles of phonograph cabinets has recently been produced by the Radio Corporation of America. This set, which is illustrated in the photograph herewith, is so constructed that it is comparatively thin and therefore can be placed in the lid of a standard phonograph, as shown directly above. In this way it does not interfere with the operation of the phonograph and when the radio set is to be used, a loud speaking unit can be attached to the end of the tone arm of the phonograph and the acoustic qualities of the phonograph horn can be utilized for reproduction of music and sounds. Thousands of dollars have been spent for research work in the construction of phonograph horns and it is well to make use of the fine qualities of the units such as are now produced. In this way an excellent loud talker can be had without any very great expense.

As will be seen in the photograph above, the necessary battery leads are brought out from one corner of the receiving set panel and can be brought down in back of the phonograph cabinet to the batteries. If desired, and if room is available a still more compact unit could be made by placing the "A" and "B" batteries in the cabinet provided for records. If this is not desired, or space cannot be given over to the batteries, a small box could readily be made and placed directly alongside the cabinet, where the batteries could be placed and concealed from sight. Binding posts on the top of the box would provide a convenient method of connecting.

In the center photograph above is shown a complete view of a phonograph containing the Radiola 9 in the lid. The tuning controls are readily accessible and since U. V.-199 tubes are used, they are not in the way when the lid is closed. The photographs directly above and to the left show the same type of receiving set included in two different types of period models of phonographs. In either of the two latter cases, there is plenty of room for the location of the batteries directly back or below the receiving set proper. This receiving set is designed to operate on an outside aerial and only two tuning controls are used. These are seen to be two variable condensers. There is a small coupling coil placed between the primary and secondary tuning inductances and connected directly to the ground. This is found to aid materially in tuning. Instead of connecting the potentiometer in its usual position, across the "A" battery, it is connected in series with the negative side of it and thence through a variable condenser and the secondary inductance to the grid of the first radio frequency amplifier. A "C" battery of 4½ volts is used to place a negative potential on the grids of the second radio frequency amplifier and the two audio frequency amplifiers. The cores of the audio frequency amplifying transformers are connected together and to the ground. Two shading or neutralizing coils are wound around the two radio frequency transformers and unilaterally connected to the filament circuit. By moving the switch indicated, better control of the radio frequency amplification can be obtained.



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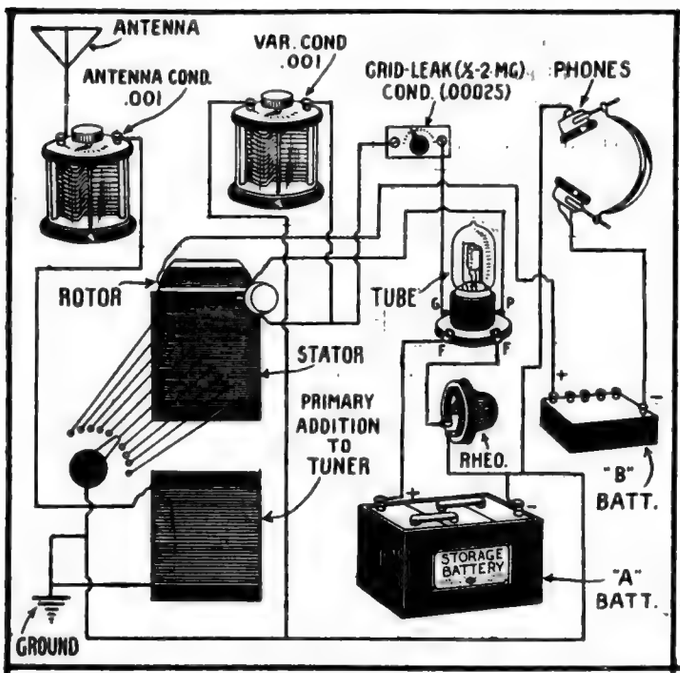
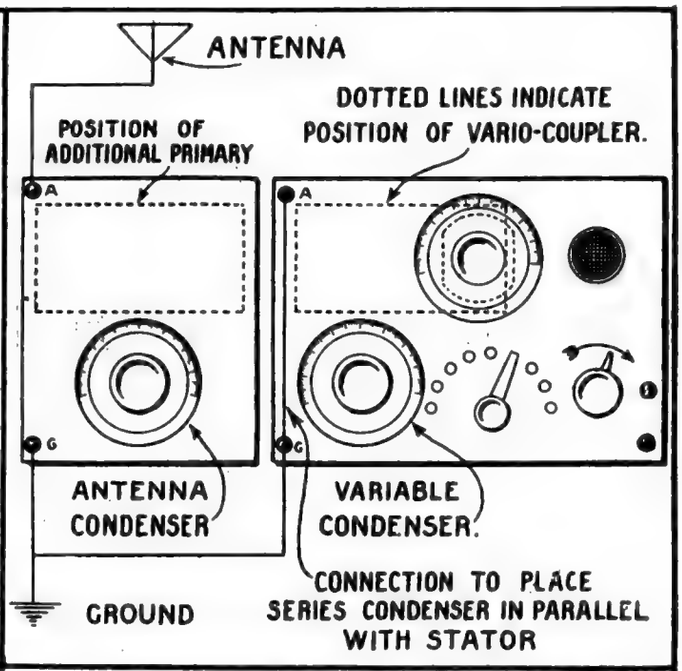
Improving the Single Circuit Tuner

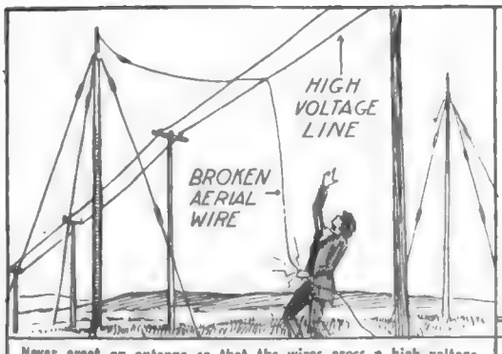


THE tuning qualities of an ordinary single circuit tuner are notoriously poor and considerable interference is caused by re-radiation from these sets. Such a set can be greatly improved and its re-radiating qualities cut down considerably by placing in the circuit an addition as illustrated above. It will be seen that the stator is no longer connected to the antenna, but goes only to the grid and filament of the tube. It is, in this circuit, the secondary. The antenna and ground are connected to a coil which is placed in inductive relation to the stator of the coupler. The rest of the circuit, aside from the primary addition, is a standard single circuit tuner. The coil should be wound on a tube the same size as the stator with the same size wire and the same number of turns.

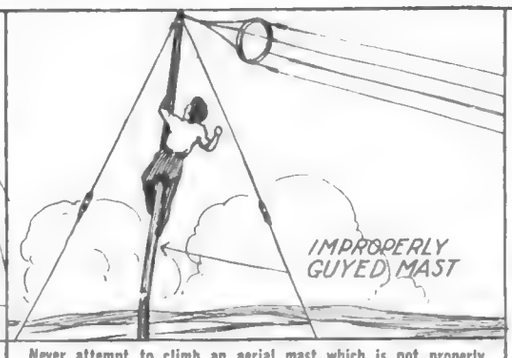


Above is illustrated a very neat and efficient method of mounting the additional primary in connection with a single circuit tuner. Of course, in placing this extra coil, it must be so arranged that it will be in inductive relation to the stator so that the lines of force from the former will cut the latter, inducing a current therein. We have shown in our above illustration how a variocoupler should be mounted horizontally instead of the usual perpendicular manner. By moving the left hand cabinet closer to or further away from the right hand cabinet, selectivity can be improved as a greater or lesser degree of coupling will be obtained. Up to a point where a transfer of energy no longer takes place, it will be found that selectivity will become greater as the coupling is increased. —Jack Kay.

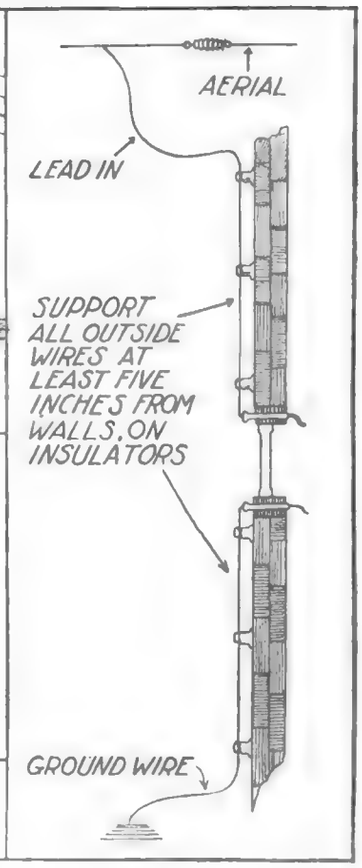
Radio Hazards

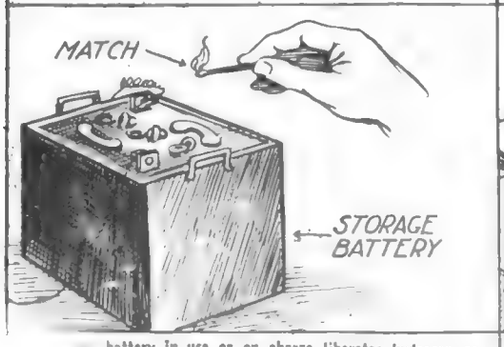


Never erect an antenna so that the wires cross a high voltage line or, for that matter, any electrical current bearing wire. If the aerial should break, and one were to pick up the broken end, a severe shock might result as illustrated above.



Never attempt to climb an aerial mast which is not properly guyed. There should always be three guys at the top of the mast and, if the latter is over 20 feet high, another set of three should be placed in the center.





battery in use or on charge liberates hydrogen gas ghly explosive. Never smoke around storage batally if the vent caps are off and never use a lighted match in looking at the electrolyte.

Above: A high voltage "B" battery can very often give quite a severe shock if the filaments of the tubes are lit. At right: To reduce the danger of fire from lightning to a minimum, all wires should be supported five inches from the building.

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Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.

NEUTRODYNE CIRCUIT

(239) Richard Jackson, New York City, asks:

Q. 1. Is it possible to make a Neutrodyne set using only three vacuum tubes?

A. 1. This is entirely possible, but you will not be able to use a loud speaker on the same except possibly for the powerful local stations. Such a set, however, is an excellent "DX" receiver for use with head phones and a circuit diagram with all the data thereon is given in these columns.

GROUNDED LOOP

(240) J. H. M. Beaty, Chester, S. C., asks:

Q. 1. What is meant by a grounded loop?

A. 1. A grounded loop antenna usually refers to a standard loop which is connected to a ground. By doing this, signal strength will be increased somewhat, but selectivity will be greatly reduced.

Q. 2. If I tap a coil wound on a 3½ inch tube every 10 turns, will a variable condenser with a capacity of .0005 mf. shunted across the coil take care of the tuning between these taps?

A. 2. Yes. In fact a coil consisting of 40 turns of No. 22 D. C. C. wire on a 3½ inch tube without any taps whatsoever will cover the band of broadcasting wavelengths when shunted by a .0005 mf. variable condenser.

Q. 3. When a coil is to be tuned by means of a parallel condenser, what is the highest capacity that should be used?

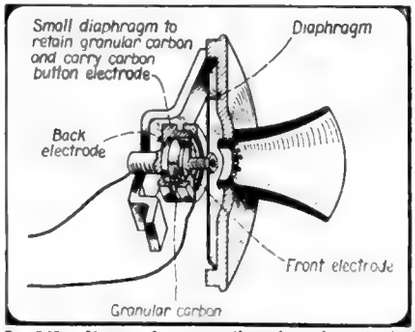
A. 3. In placing a condenser in parallel with an inductance coil a capacity of no more than .0005 mf. should be used so as to preserve the correct relationship between the inductance and the capacity. When it is found that a station cannot be tuned in with the .0005 mf. condenser at maximum, the amount of inductance should be increased.

MULTI-WAVE COUPLER SUPPORT

(241) Geo. A. Patterson, Wichita Falls, Texas, asks:

Q. 1. In reference to the multi-wave Reinartz receiver described in the December issue of SCIENCE AND INVENTION, what length will the sides of the metal support for the rotor have to be?

A. 1. The length of the sides of the support for the rotor and stator of the multi-wave coupler you mention will depend entirely upon the size of the coils employed. This could be very readily ascertained by obtaining your two coils, mounting the rod in the rotor and placing it in its relative position to the stator. The measurements can then be taken directly.



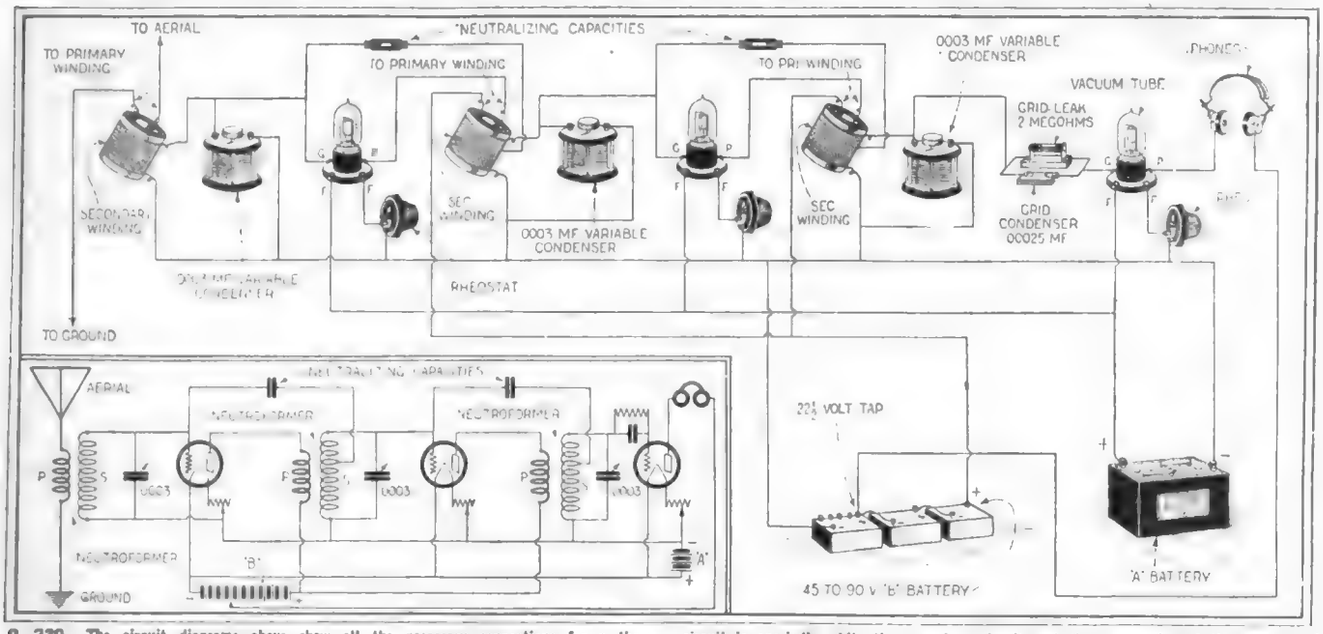
Q. 242. Above: A cross-section view of a standard telephone microphone employing carbon granules for varying the current in accordance with the fluctuations of the voice.

THE INTERIOR OF A MICROPHONE

(242) Robert Bailey, San Francisco, Calif., wants to know:

Q. 1. How is the interior of a microphone such as used in radiophone transmission arranged?

A. 1. A microphone similar in construction to an ordinary telephone transmitter may be used for this work and we illustrate herewith a cross-section of such a transmitter showing the component parts.



Q. 239. The circuit diagrams above show all the necessary connections for a three tube Neutrodyne receiver using Neutroformers with tapped secondaries. The antenna circuit is aperiodic while the secondary circuit and the secondaries of the second and third Neutroformers are tuned. The two diagrams above both show the same set.

A. C. HUM

(243) L. R. Forney, Fort Benning, Ga., submits a circuit diagram of his receiving set and states that it gives very good results. He says, however, that he is constantly troubled by a persistent hum which at times almost drowns out the reception. He asks:

Q. 1. Can you suggest the cause and method of eliminating this hum?

A. 1. We believe that your trouble arises not in your receiving set itself, but from induction from nearby power lines. We would suggest that you investigate this and if you find your aerial lead-in passing near a line carrying alternating current, you should cover the former with insulation, place a shield over the insulation and ground the latter. Other than this, there is practically no method of eliminating the hum without the use of quite an elaborate choke coil and condenser system.

Q. 2. I have considerable trouble with howling and squealing when the second stage of audio frequency amplification is used. Can you help me toward eliminating this trouble?

A. 2. Regarding the howling obtained in your second stage, we would suggest that you try shunting a .0005 mf. condenser across the secondary of the second audio frequency transformer as well as one with a capacity of .001 mf. across the primary of the first audio frequency transformer.

Sometimes a two megohm grid leak will give better results than the small fixed condenser across the secondary of the second transformer. Both arrangements should be tried, one at a time.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of sin tube sets, reflex and other types which have proven satisf We want articles on the latest single tube receptors wi quire a minimum current from the filament battery.—

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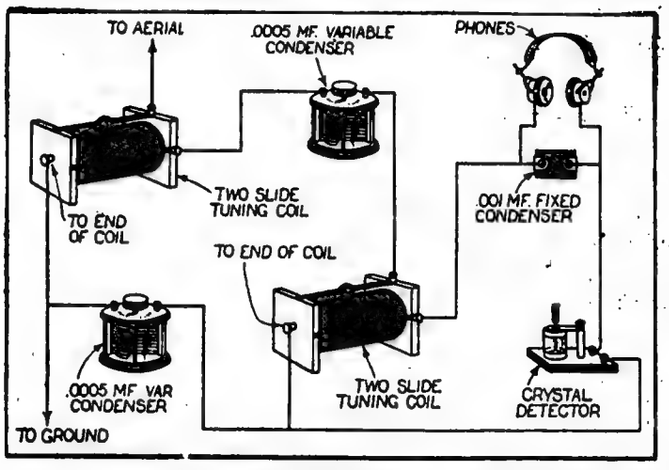
CAPACITIVELY COUPLED RECEIVER

(244) Arthur Greene, Portland, Me., asks:

Q. 1. What is the simplest circuit for use with a crystal detector which will come under the head of a capacitively coupled receiving set?

A. 1. You will find in these columns a circuit diagram showing how two variable condensers and 2 two-slide tuning coils may be connected to give very good results as a capacitively coupled receiver.



Q. 244. The circuit diagram above shows a capacitively coupled tuner using a crystal detector for rectification. This circuit may be quite sharply tuned.

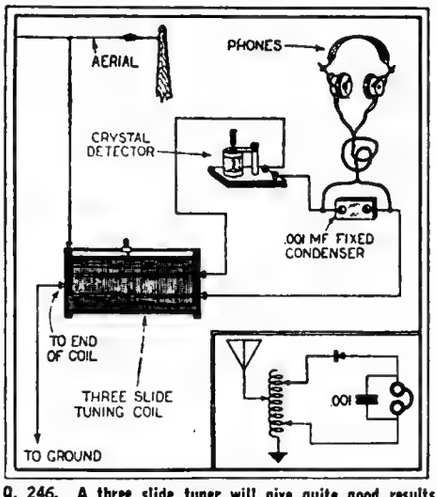
POOR RECEPTION

(245) D. C. McBride, Winchester, Tenn., states that he has made a receiving set, but is unable to get any results from the same. He asks our advice on this subject and requests some suggestions as to how to overcome his trouble.

A. 1. In the first place, we would suggest that you try reversing the polarity of your "A" battery. Some tubes work best with the negative side of the "B" battery to the positive of the "A" battery, and some with negative to negative.

Another thing is that we would not advise you to use the open circuit jacks which you indicate in your diagram, because when your phone plug is in the jack for the detector tube, you will find that your phones are shunted by the entire resistance of the primary of the amplifying transformer. When the plug is in the first step jack, the phones are in series with the entire resistance of the primary of the second amplifying transformer. In either case the results obtained will be greatly inferior to those obtained when using two-circuit jacks.

In his experience, the editor has always found that when building up a new set it is much better to start with just the tuner and the detector and to add later one or two steps of amplification. We would advise that if you do not obtain the desired results otherwise, that you try this. Just hook up your variable condenser, variocoupler, variometers, and grid leak and condenser with your detector tube, "A" and "B" batteries and phones. You should not have the least trouble in making this type of set work, and you can operate it, and at the same time notice the various characteristics of your detector tube, which are shown during the operation of the set. You will also be able to learn how to tune this particular type of tuner. After you get this set working well, and have thoroughly mastered the tuning, and adjustment of the detector tube, you are ready to add one step of amplification. Try this for a while, and then add your second step. We are sure that you will then obtain the desired results.



Q. 246. A three slide tuner will give quite good results when used with a crystal detector as shown above. The selectivity would be improved by placing a variable condenser across the two sliders which are connected to the detector and phones.

THREE SLIDE TUNER CIRCUIT

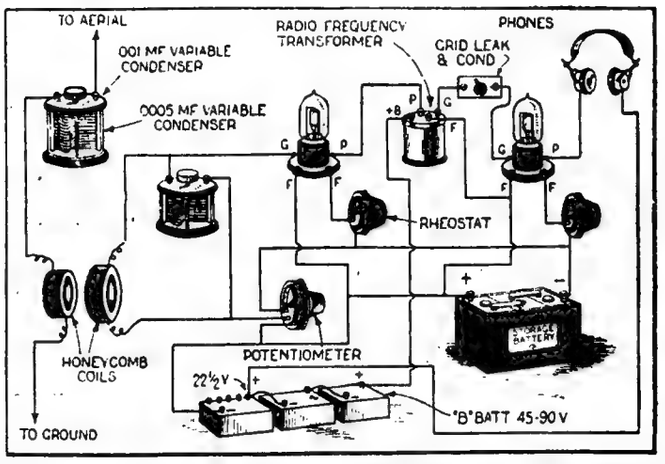
(246) Gilbert Marks, London Mills, Ill., requests:

Q. 1. Can you give me a circuit diagram showing how to connect up a standard three slide tuning coil, a crystal detector and a fixed condenser?

A. 1. The circuit for this work appears in these columns.

R. F. WITH TWO CIRCUIT TUNER

(247) Ross Kirberg, Ness City, Kansas, asks:



Q. 247. A two circuit tuner which does not employ regeneration will be made much more sensitive by adding one stage of R. F. as shown above.

Q. 1. Can you give me a circuit diagram for connecting one stage of radio frequency amplification with a two honeycomb coil tuner?

A. 1. The diagram you request is given in these columns.

QUERY ON VARIO-COUPLER

(248) Alex Maderia, Erie, Penn., refers to a circuit diagram published in this magazine in which two connections were shown to the stator of a vario-coupler. He states that he has a coupler, but it is of a different style, having fourteen taps on the primary or stator. The coupler pictured in the magazine had taps every tenth turn only. He asks:

Q. 1. How can I hook up to this vario-coupler?

A. 1. The connections to your vario-coupler will depend upon the style you have on hand. In all probability, your 14 tap vario-coupler is tapped 7 times in tens, and 7 times in units. If such is the case, you will connect all the tens taps to the points of one 7-point switch, and the units to the points of the other 7-point switch. One switch arm is then connected to the aerial condenser, and the other to the ground.

ANTIQUATED TUNING COIL

(249) Norman Peterson, Concord, Calif., describes a tuning coil, wound with bare copper wire and mounted so that it may be revolved. He then proposes to make contact with the wire by turning the coil and having a slider follow the convolutions of wire. He asks:

Q. 1. Would such a coil be of value?

A. 1. The idea you have was used in the original Marconi installations. It makes a very cumbersome apparatus.

200 ILLUSTRATIONS—100 ARTICLES

is the average of every issue of Radio News. We doubt if there is a radio magazine in print that can show the diversity of articles and illustrations that is found in this magazine.

But above all, it is the quality of the material that is of prime importance to the man interested in radio. Radio News appeals to all factions: the Scientist, the Amateur, the Experimenter, the Broadcast Listener, and the Manufacturer. Each will find articles written especially for him. Every issue of Radio News is a radio education by itself. Sold on 35,000 newsstands in the United States and in every international book store in every civilized country the world over.

INTERESTING ARTICLES APPEARING IN THE APRIL ISSUE OF "RADIO NEWS"

The ...doah's Radio Installation, By S. R. Winters

...he Ultra Radio Frequencies, ...Dunmore and Francis H. Engel

...ement and Anticipation, By Sir Oliver Lodge

Loud Speakers and How They Work, By E. Alexander

Recent Novelties in Thermionic Tubes for Radio Work—Part II. By J. A. Fleming, M.A., D.Sc., F.R.S.

Oscillating Crystals for Wavemeter Calibration, By Russell G. Harris

Neutrodyning Audio Frequency Amplifiers, By Clyde J. Fitch

Getting the Most Out of the Small Transmitter, By Brainard Foote

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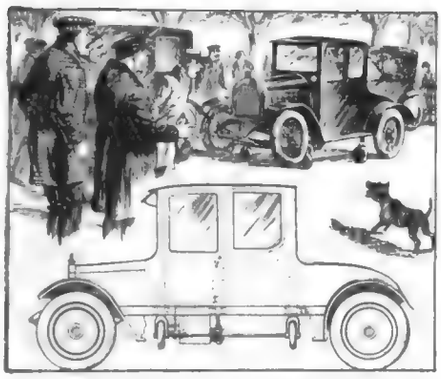
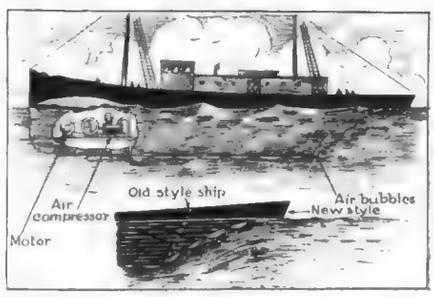
Parking System



No. 1,473,369 issued to M. S. F. Williams and John K. E. Diffenderffer. It frequently happens that the space at street curb or the side of a road is sufficient to accommodate an automobile, but is not sufficient to allow the same to be steered into place by the usual manipulation of the steering and driving mechanisms, or sometimes the owner of the automobile finds the cars parked so close to him that it is impossible for him to drive his car out. With the present system attached to an automobile this will always be possible. Four wheels placed on a special chassis beneath the car body are first driven downwardly jacking the car up, and then power is applied to them, causing the car to move out sideways from the curb.

Air Propelled Vessel

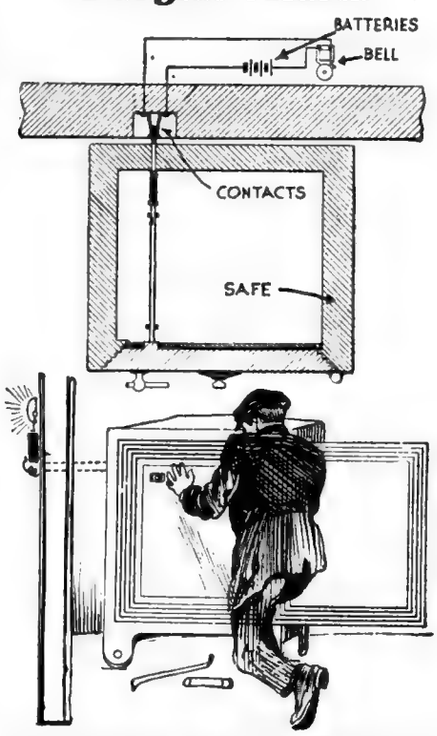


No. 1,475,393 issued to H. A. J. De B. Nachenius. In those vessels which are propelled by gas or air discharged below the water level, a substantially plain surface forms the stern face of the vessel. As the bubbles pass upward the vessel is, of course, propelled in a forward direction, but due to a wave formation a lot of energy is lost because the air must lift the water above the surface. The stern of the vessel is so curved that the top of its curve conforms with the water level making it impossible to lift the water.

Psychic Instrument

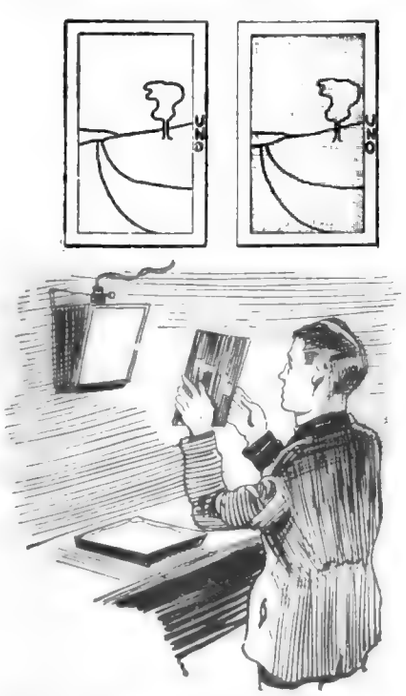
No. 1,476,158 issued to Grover C. Haffner. In the psychic instrument shown above a board is so mounted that it can easily be tilted. A pointer is mounted on the table in such a manner that when the ouija board is tilted the pointer will move from right to left across the face of the board. In the operation of the device two people sit in front of the board, as indicated in the above sketch. When placing the hands upon the board, it is impossible to maintain it in a relativley fixed position. Consequently the pointer will be found to move whenever the table is tilted in a clockwise direction.

Burglar Alarm



No. 1,472,750 issued to James F. Gorman and Frank C. Gorman. Whenever the door of the safe shown above is opened an insulating pin which holds the two contacts open, slips out of position between these contacts. The latter close the circuit to a bell conveniently situated.

Photographic Gauge



No. 1,469,415 issued to Walter F. Herzberg. In taking pictures it is quite necessary that the development of the negative continue until it has been normally developed, regardless of whether the negative has been under or over-exposed. Intensifiers, reducers and such means are used in order to bring out the contrast in the negatives, but the amateur photographer finds it difficult to determine exactly when his negative has been normally developed. The inventor of this system places a series of indices alongside of the negative with the letters U, N and O appearing thereon, representing respectively under-developed, normally developed and over-developed. The letters are treated with chemicals in such a manner that they appear progressively as the development is continued, and therefore, when the solution weakens due to use, the letter N will not appear until development has been carried on long enough to produce a normal negative.

Aircraft Hangar

No. 1,470,557 issued to Ivan I. Eremeeff. Three houses are mounted on wheels and rails provided. When assembled the hangar resembles a T, having one section for the fuselage and right and left for each set of wings.

Lemon Squeezer

No. 1,469,514 issued to Peter Juergensen. In the illustration shown above a dish is provided with a series of rods which extend upward and are joined by a disk at the top. Through the center of this disk a rod extends. Surrounding the rod a tubular member may be found having a plurality of diverging arms, whose lower portions have inwardly directed arms. This tubular member may be rotated freely. When the knob on top of the device is pushed downward, the pointed arms are caused to embed themselves into the sides of the lemon. When so firmly embedded the hand wheel is rotated. This causes the lemon to turn on a knob-shaped device at the bottom of the dish, whose sides are arranged with [illegible] nations. The juice from the lemon is [illegible] moved without soiling th[illegible]

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Scientific Humor

THE LATEST HIT

DROPPING PARACHUTIST (*to himself*): "There seems to be something wrong with my patent parachute, but I will hit upon something presently!"—*S. H. Harrison.*

AND SO KOP SPELLS POLICE

TEACHER (*conducting first year spelling class*): Can any little boy or girl spell a new word for us?

SON OF RADIO FAN (*raising hand*): I can spell Pittsburgh.

TEACHER: How do you spell Pittsburgh?

LITTLE BOY: K D K A.—*Robert Radsch.*

SOME NEW HOOK-UPS NEED ONE

AUNT ENNA: "Is Ralph very stupid?"

D. TECKTOR: "Stupid! Why he's so dumb he thinks a radio fan is an apparatus used to keep a receiving set from becoming overheated." — *Irven K. Rimbey.*

OF GREAT INTEREST

A number of men were having a discussion as to who was the greatest inventor. Some said Edison, some said Marconi, and some said Morse, while still others said different men were.

Finally, a small German got in a word and said:

"Vell, chentlemens, dose vas great peoples, but I tell you, de man vot invented interest vas no slouch.—*T. H. Buescher.*

THIS IS STATION E.V.E.

"Radio is one of the first things mentioned in the Bible."

"What do you mean?"

"Well it says there that Adam made a loud speaker out of a spare part."

"Uh huh! And the loud speaker raised Cain, I suppose."—*A. Zimmerman.*

WATER ON THE BRAIN

During an experiment flight a dirigible was struck by a sudden storm, and wrecked. The friends of a certain professor who had been a passenger were greatly alarmed, "For," they said, "he would naturally forget to pull the release cord of his parachute."

A subsequent report found this to be the case, but added:

"He had been pondering a question during the flight and as he fell he became aware that the rain on his head annoyed him. But he reflected that his parachute would serve as an umbrella, pulled the cord, and descended in safety."—*W. L. Hastry, Jr.*

TO BE BOILED IN 'OHM JUICE

SPARK: "Think I'll go trouble shootin'."

GAPP: "An' kilowatt?"

SPARK: "Oh, some aqueducts, maybe."—*Joseph M. Straughan.*

LET HIM TRY IT WITH A PIPE OF PEACE

JONES: "I only use smokeless tobacco."

BROWN: "What kind is that?"

JONES: "Chewing."—*Henry B. Davenport.*

First Prize $3.00

AN ALARMING INVENTION

"What's this new invention of yours?" asked the promoter.

"It's an up-to-date alarm-clock," replied the inventor. "You will notice that instead of a bell it has a bugle that blows reveille."—*J. J. O'Connell.*

A CELLEBRATED JOKE

PROFESSOR: "Who can tell me what a tissue is?"

STUDENT: "A tissue is a collection of cells all of which are similar."

PROFESSOR: "Now illustrate."

STUDENT: "A prison!"—*Francis Sielski.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. No letters acknowledged unless postage is included.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to "tie" for the prize, then the sum of three dollars in cash will be paid to each one.

"BODY CAPACITY"

SAM: "You look worried today, Bill."

BILL: "Yes, I took my girl to an ice cream parlor last night and she ate four quarts of ice cream."

SAM: "Well, did that make you go broke and become worried?"

BILL: "No, I can't solve how a girl can eat so much ice cream."

SAM: "Well, well, you just pick up an arithmetic book and you will find that four quarts equals one gal. (gallon)."—*A. J. Lozouski.*

WE'LL CONDENSE THIS JOKE TO 10 CENTS, *Editor S. & I.*

EDITOR: Say, you'll have to condense this article.

SCIENTIST: It's already condensed.

EDITOR: What's it about?

SCIENTIST: Steam.—*C. S. Garrison.*

INSULATED

"Oh, I wish I could find some place where I could be cut off entirely from the world."

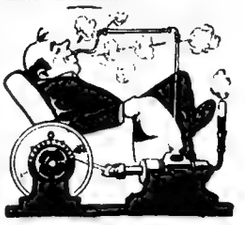
"Try a telephone b[illegible]" — *Victor*

THE CORRECT "HOOK-UP"

One Sunday morning, Mr. Gray felt an urge to do a bit of carpentering in connection with his receiving set. After the family and the good neighbors next door were safely off to church, he got out his tools and had a busy time. When the new shelf was screwed up, the grid-leak overhauled, and all the connections tightened, he turned up the rheostat and twiddled the dials. From the loud speaker came a solemn, ministerial voice,

"Remember the Sabbath day, to keep it holy!"—*Mrs. J. W. Swain.*

AN EVEN DRAW



ANGRY CUSTOMER: This cigar you sold me refuses to draw.

ISAAC: Vell, mine good friend, did you tink dat I vould furnish you vit a suction pump for only five cents? *Daniel C. MacLeod.*

WHY JOKE EDITORS DIE YOUNG

PROFESSOR: "What proof have you to show that convulsion is contagious?"

STUDENT: "When our baby goes into convulsions my mother gets a fit."

PROF.: "Now, tell me what other name they call a tumor?"

STUDE.: "Can't sir."

PROF.: "Correct."

PROF.: "What kind of organ is the trachea?"

STUDE.: "A pipe organ."

PROF.: "Have you read any articles on salt?"

STUDE.: "Yes. Lot's."

PROF.: "Do you know what organ catarrh effects?"

STUDE.: "No, sir" (nose, sir).

PROF.: "A very good answer."—*George Fuller.*

A GOOD CATCH

The train jerked to a sudden stop. The brakeman hurried through to the rear end to flag. A smart young gent blurted out, "Hey there, brakie, what's the matter? Did one of Henry Ford's masterpieces park itself on the track?"

"No," replied the brakeman. "The matter is not as serious. The cow-catcher had a calf."—*Neil Miller.*

A POSITIVE ANSWER

JIGGS: "Are you an amateur photographer?"

JAGGS: "No. Why do you ask?"

JIGGS: "I heard that you got Miss Filmstar's negative last night."—*John H. Schalck.*

RADIO FLATTERY

A radio fan named McSlattery
Turned on too much juice from his battery;
Then tuned and—Great Scott!
The noises he got
Were like Amateur Night in a cattery.—*Mrs. J. W. Swain.*

QUO VADIS?

TEACHER: What's the difference between an explosion and a collision?

STUDENT: Well, in a collision you're here, and in an explosion where are you?—*M. D. Johnson.*

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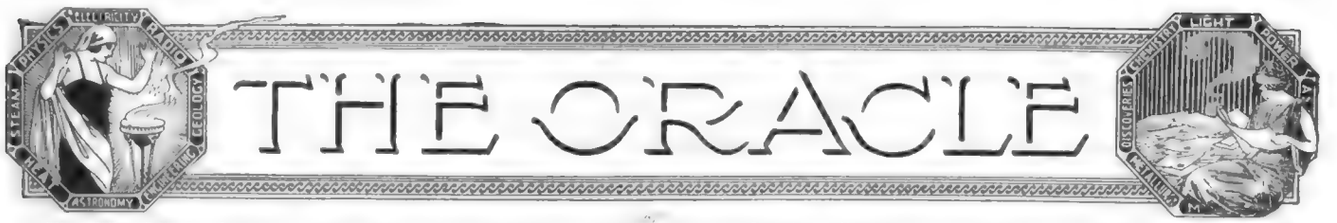


THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

SPARK PLUG CONSTRUCTION

(1645) Charles T. Praser, Bronx, N. Y., says: "A" claims that the center electrode in a spark plug is molded in the porcelain. "B" claims that it is inserted after the porcelain has been molded.

Q. 1. Which is correct?

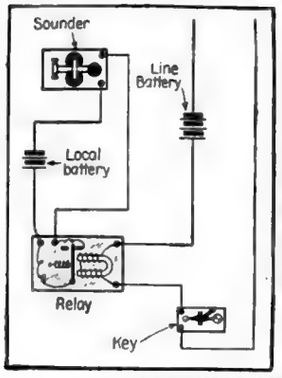
A. 1. B is correct. The baking temperature for porcelain is so high that the metal electrode would fuse during the process.

TELEGRAPH CIRCUIT

(1646) A. Dansen, Chicago, Ill., says that he has connected up a telegraph line with a neighbor's house, but the current flowing through the line is so weak that it will not operate a sounder at one end of the line when the key is closed at the other end. He asks:

Q. 1. How can I connect a relay and a local battery in this circuit so that satisfactory results can be obtained?

A. 1. The circuit diagram for this work is given herewith. The relay, capable of working on a small current, closes a local circuit and the local battery actuates the sounder.



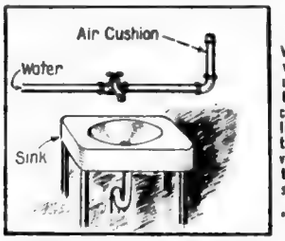
When a comparatively long telegraph line is used, the current at the receiving end is very seldom sufficient to operate a standard sounder. In this case, it is necessary to employ a relay, which operates on a low current, to close local battery circuit as shown, at the left.

A HYDRAULIC QUERY

(1647) Harry Jackson, San Antonio, Texas, says that he has very often noticed that on a water pipe, the pipe itself extends past a faucet for a short distance and turns at right angles, where, after continuing for another short distance the end of the pipe is capped. He asks:

Q. 1. What is the reason for this extra length of pipe?

A. 1. The diagram herewith shows the conditions under discussion. The short right angle arm acts as an air cushion in the following manner. When the faucet is open, the water starts flowing out at a full strength. If now the faucet is suddenly closed, the water tends to keep on flowing and would bump the end of the pipe with



Where high pressure water systems are used it is necessary to have an air cushion in the pipe line as shown at the left. This prevents damage to the pipe as described in the text.

considerable force if the cushion were not provided. The well known "water hammer" works on this principle and even in household installations it has been found that this shock is sometimes sufficient to burst the pipe. For this reason, the air space shown is included in the pipe system so that the cushion will take up enough of the force to prevent breakage of the pipe.

Interesting Articles to Appear in April Issue of "Practical Electrics"

Odd Telephones, By Clyde J. Fitch
Analogies and Others, By T. O'Conor Sloane, Ph.D.
Detection of Icebergs
Austrian Rival of Franklin
Infra-Red Light Telephony, By Jacques Boyer (Paris Correspondent)
Building a Thermo-galvanometer
Electric Oil Feed for House Furnace, By George E. McVicker
Farm Windmill Electric Plant
Hot-Wire Ammeter
Cigarette Holder and Lighter
Cable Guided Ocean Liner, By Raymond F. Yates
Copying and Enlarging Machine, By Roy Hale

GRAVITY CELL

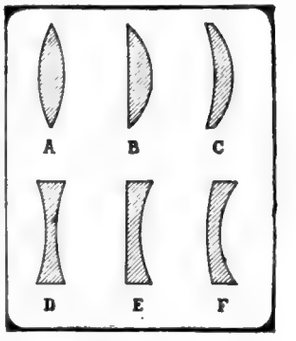
(1648) Richard Falk, Wantagh, L. I., asks:

Q. 1. Can you give me directions for setting up and operating a gravity cell?

A. 1. To set up a gravity cell, place the copper electrode in the bottom and completely cover it with a saturated solution of copper sulphate in water. It is usually advisable to have a quantity of copper sulphate crystals lying in the bottom of the jar, so as to keep the solution in a state of constant saturation. On top of this solution, which occupies about three-quarters of the jar, is carefully poured a weak solution of zinc sulphate in water, so that the two will only slowly mix. The saturated solution of copper sulphate being denser will remain on the bottom unless agitated, and will only gradually rise to the top. In the zinc sulphate solution suspend the zinc electrode. If the copper sulphate solution reaches the zinc, metallic copper is precipitated on it causing local action and polarization.

These batteries deteriorate more quickly if kept on an open circuit than if kept in use, and they are, therefore, generally used in closed circuit burglar alarms, telegraphy and other closed circuit work.

At the right will be seen diagrams showing the various types of lenses in common use. The lenses in the illustration are all lettered and the terms used to designate the various lenses are given in the text.



LENSES

(1649) K. R. Mitchell, Annadale, S. I., asks:

Q. 1. Kindly illustrate and name six of the common types of lenses.

A. 1. We give herewith illustrations of lenses as requested. Lens A is a double convex, B, plane-convex, C, concave-convex or meniscus, D, double concave, E, plane-concave, F, convex concave.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 9,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

INTERESTING ARTICLES TO APPEAR IN MAY ISSUE OF "SCIENCE AND INVENTION"

Animal Eating Plants. By Dr. Ernest Bade
Alps Mountain Railway—Remarkable Photos and Diagrams.
Artificial Creation of Life. By John F. Mazur and Dr. E. Bade
Distortion Photographs. By S. H. Samuels
Electric Marionettes.
Odd Uses for Paper. By Ismar Ginsburg, B.S., Chem. Eng.
Cigar Box Contest "Prize Awards"
Timing Cannons Electrically. By Raymond Francis Yates
Plant Experiments in the Home. By Dr. Russel G. Harris, Jefferson Physical Laboratory, Harvard University.
Fishing with Hydrogen Balloons.
Painted Movie Scenes Rival Natural Settings. By Tamar Lane
Double Decked Railways of Tomorrow. By George F. Murphy
Aspects of Interstellar Communication. By Chevalier de Terrail
The Infinite Vision. By Charles C. Winn
Daylight Saving in Ancient Rome. By Charles Beecher Bunnell

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

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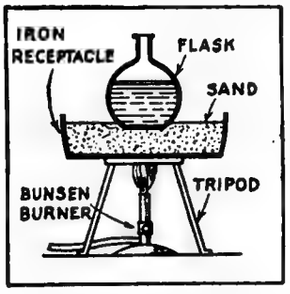
SAND BATH

(1650) J. W. Mahoney, Elizabeth, New Jersey, asks:

Q. 1. Can you give directions for making a sand bath for use in heating chemicals and state the reason for its use?

A. 1. Our illustration herewith shows how a sand bath should be set up. The iron receptacle is supported on a tripod over a Bunsen burner and partly filled with sand. The flask or other container to be heated is imbedded slightly in the sand and the burner lighted. The advantage of a sand bath is that an even heat is supplied to the flask and danger of breaking it from sudden changes of temperature is avoided.



At the left is shown the correct method of setting up a sand bath for use when heating chemicals which must be carefully treated. The uses of the sand bath are given in the text.

RECOVERY OF SILVER FROM PHOTOGRAPHIC NEGATIVES

(1651) W. J. LaChapelle, San Francisco, Cal., asks the Oracle:

Q. 1. Can the silver contained in the emulsion used on photographic negatives be recovered?

A. 1. It is entirely possible to recover the silver from photographic negatives. The process is as follows: With hot water remove all the emulsion from the film, and dissolve it. Treat the solution with nitric acid, which changes the silver into the form of a nitrate. After gas has stopped coming off from the solution, treat the remaining solution until practically all the solid matter is dissolved. If you find that some of it does not dissolve, you will know that this is probably not silver. Next prepare a saturated solution of common salt. This is added to the solution obtained as above, and the result heated to the boiling point. A white insoluble precipitate of silver chloride will be formed, and it should be removed by filtering. Add a small quantity of dilute sulphuric acid to the silver chloride placed in a glass vessel, and place therein a small amount of zinc in any metallic form. Owing to the electrolytic relations of zinc and silver, zinc chloride will be formed and the silver will be precipitated in the form of a grayish spongy mass. This can be reduced to lump form by melting it with a blow pipe.

VOLUME MEASURED BY DISPLACEMENT

(1652) Jesse Reiss, Chicago, Ill., requests:

Q. 1. How can the volume of an irregularly shaped object which is insoluble in water be determined?

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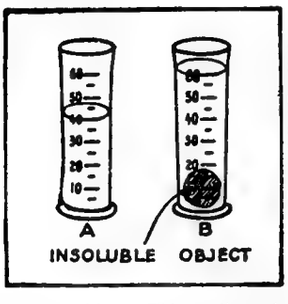

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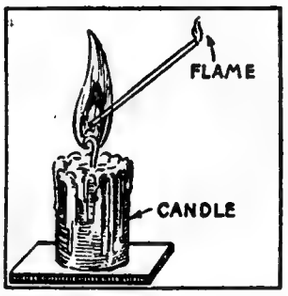

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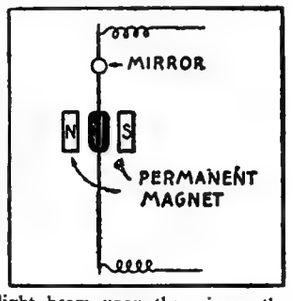

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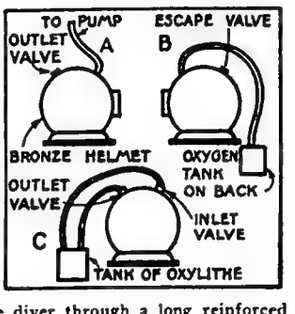

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"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"

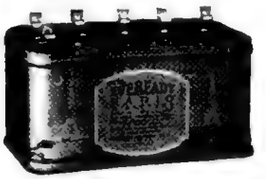
Why Big Cells Count in Radio "B" Batteries

THIS handsome metal case Eveready "B" Battery No. 766 costs only two-thirds more than the smallest Eveready "B" Battery, but it *contains seven times the electricity!* This makes the No. 766 over four times as economical as its baby brother. That is why most people buy it.

Its fifteen large cells give 22½ volts of strong, steady energy day after day. Cells that pour out power the moment you turn on your tubes. Cells that rest well when idle, renewing their vigor for your next demands.

No cells have a bluer-blooded ancestry than these. They are the product of thirty years of dry battery research and development of the world's foremost electro-chemical laboratories. We think that No. 766 is the handsomest battery ever made. But that is a matter of opinion. It is a matter of engineering record, however, that this great standard "B" Battery has proved itself as perfect in performance as we are convinced it is superfine in appearance.

The 45-volt Eveready No. 767 contains the same large powerful cells as the No. 766. For maximum "B" Battery economy, therefore, buy the 22½-volt Eveready No. 766 or the 45-volt Eveready No. 767, as you prefer. Here is the "B" Battery at its best.



Eveready "B" Battery No. 766
22½ volts. Six Fahnestock Spring Clip Terminals, giving variable voltage from 16½ to 22½ volts, in 1½-volt steps. Length, 6¾ in.; width, 4⅛ in.; height, 3 3/16 in. Weight, 5 lbs.

NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco
Canadian National Carbon Company, Limited
Factory and Offices: Toronto, Ontario

If you have any radio battery problem, write to G. C. Furness, Manager, Radio Division, National Carbon Company, Inc., 209 Manley Street, Long Island City, N. Y. Informative and money-saving booklets on "A," "B" and "C" Batteries sent free on request.

Eveready 6-volt Storage Battery

No. 764 The Space Saver Vertical 22½-volt "B" Battery

Eveready Radio "A" Dry Cell Specially manufactured for use with dry cell tubes

No. 767 "B" Battery, 45 volts Variable taps Fahnestock Clips

No. 771 "C" Battery Clarifies tone and increases "B" Battery life

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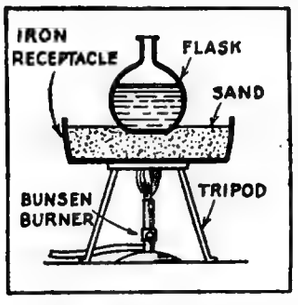
SAND BATH

(1650) J. W. Mahoney, Elizabeth, New Jersey, asks:

Q. 1. Can you give directions for making a sand bath for use in heating chemicals and state the reason for its use?

A. 1. Our illustration herewith shows how a sand bath should be set up. The iron receptacle is supported on a tripod over a Bunsen burner and partly filled with sand. The flask or other container to be heated is imbedded slightly in the sand and the burner lighted. The advantage of a sand bath is that an even heat is supplied to the flask and danger of breaking it from sudden changes of temperature is avoided.



At the left is shown the correct method of setting up a sand bath for use when heating chemicals which must be carefully treated. The uses of the sand bath are given in the text.

RECOVERY OF SILVER FROM PHOTOGRAPHIC NEGATIVES

(1651) W. J. LaChapelle, San Francisco, Cal., asks the Oracle:

Q. 1. Can the silver contained in the emulsion used on photographic negatives be recovered?

A. 1. It is entirely possible to recover the silver from photographic negatives. The process is as follows: With hot water remove all the emulsion from the film, and dissolve it. Treat the solution with nitric acid, which changes the silver into the form of a nitrate. After gas has stopped coming off from the solution, treat the remaining solution until practically all the solid matter is dissolved. If you find that some of it does not dissolve, you will know that this is probably not silver. Next prepare a saturated solution of common salt. This is added to the solution obtained as above, and the result heated to the boiling point. A white insoluble precipitate of silver chloride will be formed, and it should be removed by filtering. Add a small quantity of dilute sulphuric acid to the silver chloride placed in a glass vessel, and place therein a small amount of zinc in any metallic form. Owing to the electrolytic relations of zinc and silver, zinc chloride will be formed and the silver will be precipitated in the form of a grayish spongy mass. This can be reduced to lump form by melting it with a blow pipe.

VOLUME MEASURED BY DISPLACEMENT

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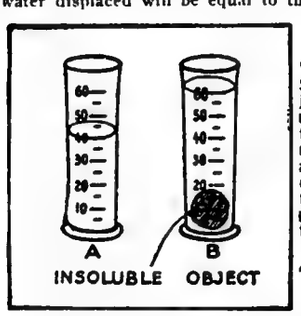

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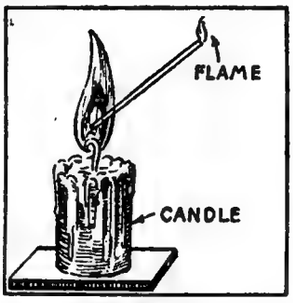

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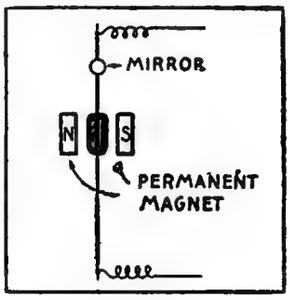

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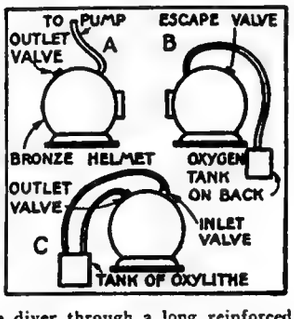

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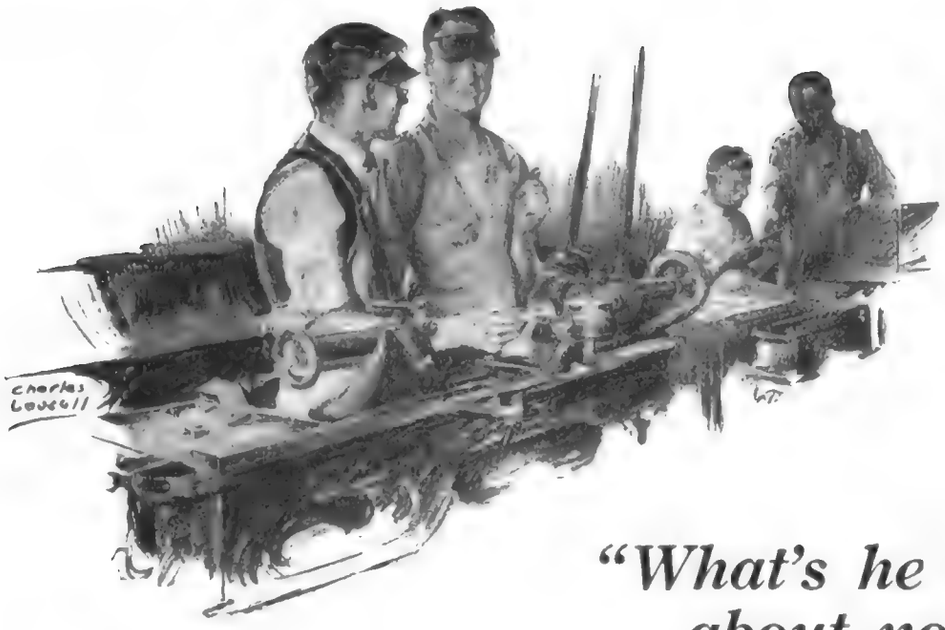

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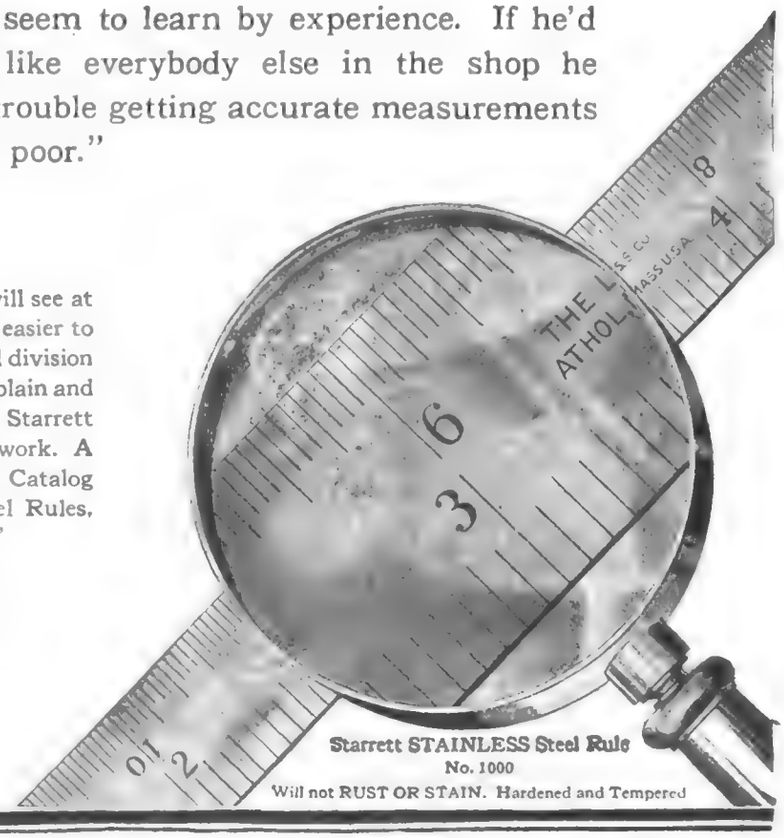

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Radio Broadcast

Revised and corrected to date

First Group of figures indicate the power in watts in the antenna of the transmitting station. The second group gives the wave-length.

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—270
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Telegram Publishing Co.,	Salt Lake City, Utah	50—360
KDYM	Savoy Theatre,	San Diego, Cal.	100—280
KDYQ	Oregon Institute of Technology,	Portland, Ore.	100—360
KDYW	Smith Hughes Machinery Co.,	Phoenix, Ariz.	20—360
KDYX	Star Bulletin,	Honolulu, Hawaii	100—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZF	Automobile Club of Southern California,	Los Angeles, Calif.	500—278
KDZI	Electric Supply Co.,	Wenatchee, Wash.	50—360
KDZQ	Nichols Academy of Dancing (Hal G. Nichols),	Denver, Colo.	10—360
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	500—360
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywood, Calif.	200—280
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAW	The Radio Den (W. B. Ashford),	Santa Ana, Calif.	10—280
KFAY	Virgin's Radio Service (W. J. Virgin),	Medford, Ore.	50—283
KFBB	F. A. Buttrey & Co.,	Havre, Mont	50—360
KFBC	W. K. Azbill,	San Diego, Calif.	10—278
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	10—360
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	100—283
KFBL	Leese Bros.,	Everett, Wash.	10—224
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	10—360
KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—278
KFCF	Frank A. Moore,	Walla Walla, Wash.	100—360
KFCH	Electric Service Station, Inc.,	Billings, Mont.	10—360
KFCM	Richmond Radio Shop (Frank T. Doeing),	Richmond, Calif.	100—360
KFCP	Ralph W. Flygare,	Ogden, Utah	25—360
KFCV	Fred Mahaffey, Jr.,	Houston, Texas	10—360
KFCY	Western Union College,	Le Mars, Iowa	50—252
KFCZ	Omaha Central High School,	Omaha, Neb.	100—258
KFDA	Adler's Music Store,	Baker, Ore.	5—360
KFDD	St. Michaels Cathedral,	Boise, Idaho	10—252
KFDH	University of Arizona,	Tucson, Ariz.	150—360
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	50—360
KFDL	Knight-Campbell Music Co.,	Denver, Colo.	5—360
KFDO	H. Everett Cutting,	Bozeman, Mont.	50—248
KFDR	Bullock's Hardware & Sporting Goods (Robert G. Bullock),	York, Neb.	10—360
KFDV	Gilbrech & Stinson,	Fayetteville, Ark.	200—360
KFDX	First Baptist Church,	Shreveport, La.	100—360
KFDY	South Dakota State College of Agriculture and Mechanic Arts,	Brookings, S. D.	100—360
KFDZ	Harry O. Iverson,	Minneapolis, Minn.	5—231
KFEC	Meier & Frank Co.,	Portland, Ore.	50—360
KFEJ	Guy Greason,	Tacoma, Wash.	10—360
KFEL	Winner Radio Corp.,	Denver, Colo.	50—360
KFEQ	J. L. Scroggin,	Oak, Neb.	150—360
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	20—231
KFEV	Felix-Thompson Radio Shop,	Casper, Wyo.	250—263
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho	10—360
KFEZ	Amer. Society of Mechanical Engineers (F. H. Schubert),	St. Louis, Mo.	100—360
KFFB	Jenkins Furniture Co.,	Boise, Idaho	10—240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—360
KFFO	Dr. E. H. Smith,	Hillsboro, Ore.	5—229
KFFQ	Marksheffel Motor Co.,	Colorado Springs, Colo.	100—360
KFFR	Nevada State Journal (Jim Kirk),	Sparks, Nev.	10—226
KFFV	Graceland College,	Lamoni, Iowa	10—360
KFFX	McGraw Co.,	Omaha, Neb.	100—278
KFFY	Pineus & Murphey,	Alexandria, La.	100—275
KFFZ	Al G. Barnes Amusement Co.,	Dallas, Texas (portable)	20—226
KFGC	Louisiana State University,	Baton Rouge, La.	100—254
KFGD	Chickasha Radio & Electric Co.,	Chickasha, Okla.	200—248
KFGH	Leland Stanford University, (P. O.)	Stanford Univ., Calif.	500—360
KFGJ	Missouri National Guard, 138th Infantry,	St. Louis, Mo.	250—266
KFGL	Arlington Garage,	Arlington, Ore.	5—234
KFGQ	Crary Hardware Co.,	Boone, Iowa	10—226
KFGV	Heidbreder Radio Supply Co.,	Utica, Neb.	10—224
KFGX	First Presbyterian Church,	Orange, Texas	500—250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	10—268
KFHA	Western State College of Colorado,	Gunnison, Colo.	50—252
KFHB	Rialto Theatre (P. L. Beardwell),	Hood River, Ore.	5—280
KFHD	Utz Radio and Electric Co.,	St. Joseph, Mo.	100—226
KFHF	Central Christian Church,	Shreveport, La.	150—266
KFHH	Ambrose A. McCue,	Neah Bay, Wash.	50—261
KFHJ	Fallon & Co.,	Santa Barbara, Calif.	100—360
KFHR	Star Electric & Radio Co.,	Seattle, Wash.	50—270
KFHS	Clifford J. Dow,	Lihue, Hawaii	30—275
KFHX	Robert W. Nelson,	Hutchinson, Kan.	150—229
KFI	Earle C. Anthony, Inc.,	Los Angeles, Calif.	500—469
KFID	Ross Arbuckle's Garage,	Iola, Kan.	20—246
KFIF	Benson Polytechnic Institute,	Portland, Ore.	100—360
KFIL	Windisch Electric Farm Equipment Co.,	Louisburg, Kan.	30—234
KFIQ	North Central High School,	Spokane, Wash.	50—252
KFIQ	Yakima Valley Radio Broadcasting Asso.,	Yakima, Wash.	50—242
KFIU	Alaska Elec. Light & Power Co.,	Juneau, Alaska	10—226
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	250—240
KFIZ	Daily Commonwealth and Oscar A. Huelsman,	Fond du Lac, Wis.	100—273
KFJB	Marshall Electrical Co.,	Marshalltown, Iowa	10—248
KFJC	Seattle Post Intelligencer,	Seattle, Wash.	100—270
KFJF	National Radio Mfg. Co.,	Oklahoma City, Okla.	20—252
KFJI	Liberty Theatre (E. E. Marsh),	Astoria, Ore.	10—252
KFJK	Delano Radio & Electric Co.,	Bristow, Okla.	100—233
KFJL	Hardsacg Mfg. Co.,	Ottumwa, Iowa	10—242
KFJM	University of North Dakota,	Grand Forks, N. D.	100—280
KFJQ	Electric Construction Co., Valley Radio Division,	Grand Forks, No. Dak.	5—280
KFJR	Ashley C. Dixon & Son,	Stevensville, Mont (near)	5—253
KFJV	Thomas H. Warren,	Dexter, Iowa	10—224
KFJW	Le Grand Radio Co.,	Towanda, Kan.	10—226
KFJX	Iowa State Teachers College,	Cedar Falls, Iowa	50—229

(*Continued on page* 1250)

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Radio Broadcast

(*Continued from page* 1248)

Call Letters	Name	Location	Power & Wave Length
KFJY	Tunwall Radio Co.,	Fort Dodge, Iowa	50—246
KFJZ	Texas National Guard,	112th Cavalry, Fort Worth, Texas.	20—254
KFKA	Colorado State Teachers College,	Greeley, Colo.	50—248
KFKB	Brinkley-Jones Hospital Association,	Milford, Kan.	500—286
KFKQ	Conway Radio Laboratories (Ben H. Woodruff),	Conway, Ark.	150—224
KFKV	F. F. Gray,	Butte, Mont.	50—283
KFKX	Westinghouse Electric & Mfg. Co.,	Hastings, Neb.	500—286
KFKZ	Nassour Bros. Radio Co.,	Colorado Springs, Colo.	10—234
KFLA	Abner R. Willson,	Butte, Mont.	5—283
KFLB	Signal Electric Mfg. Co.,	Menominee, Mich.	5—248
KFLD	Paul E. Greenlaw,	Franklinton, La.	20—234
KFLE	National Educational Service,	Denver, Colo.	25—268
KFLH	Erickson Radio Co.,	Salt Lake City, Utah	50—261
KFLP	Everette M. Foster,	Cedar Rapids, Iowa	20—240
KFLQ	Bizzell Radio Shop,	Little Rock, Ark.	20—261
KFLR	University of New Mexico,	Albuquerque, N. M.	100—254
KFLU	Rio Grande Radio Supply House,	San Benito, Tex.	20—236
KFLV	A. T. Frykman,	Rockford, Ill.	100—229
KFLW	Missoula Electric Supply Co.,	Missoula, Mont.	10—234
KFLX	George R. Clough,	Galveston, Tex.	10—240
KFLY	Fargo Radio Supply Co.,	Fargo, N. D.	20—231
KFLZ	Atlantic Automobile Co.,	Atlantic, Iowa	10—273
KFMB	Christian Churches of Little Rock,	Little Rock, Ark.	254
KFMQ	University of Arkansas,	Fayetteville, Ark.	100—263
KFMR	Morningside College,	Sioux City, Iowa	10—261
KFMS	Freimuth Department Store,	Duluth, Minn.	100—275
KFMT	George W. Young,	Minneapolis, Minn.	5—231
KFMU	Stevens Bros.,	San Marcos, Tex.	20—240
KFMW	M. G. Sateren,	Houghton, Mich.	50—266
KFMX	Carleton College,	Northfield, Minn.	500—283
KFMY	Boy Scouts of America,	Long Beach, Calif.	20—229
KFMZ	Roswell Broadcasting Club,	Roswell, N. Mex.	500—250
KFNG	Wooten's Radio Shop,	Coldwater, Miss.	10—254
KFNH	State Teachers College,	Springfield, Mo.	20—236
KFNJ	Warrensburg Electric Shop,	Warrenburg, Mo.	50—234
KFOA	Rhodes Company (Dept. Store),	Seattle, Wash.	500—455
KFSG	Echo Park Evangelistic Association,	Los Angeles, Calif.	500—278
KGO	General Electric Co.,	Oakland, Calif.	1000—312
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Ore.	50—360
KGN	Northwestern Radio Mfg. Co.	Portland, Ore.	100—360
KGU	Marion A. Mulrony,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHQ	Louis Wasmer,	Seattle, Wash.	100—360
KJFU	Central Power Co.,	Kearney, Neb.	10—234
KJQ	C. O. Gould,	Stockton, Calif.	5—360
KJR	Northwest Radio Service,	Seattle, Wash.	100—270
KJS	Bible Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—509
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—360
KMJ	San Joaquin Lt. & Power Corp.	Fresno, Calif.	50—273
KMO	Love Electric Co.,	Tacoma, Wash.	10—360
KNT	Grays Harbor Radio Co. (Walter Hemrich),	Aberdeen, Wash.	250—263
KNV	Radio Supply Co.,	Los Angeles, Calif.	100—256
KNX	Electric Lighting Supply Co.,	Los Angeles, Calif.	100—360
KOB	New Mexico College of Agriculture and Mechanic Arts,	State College, N. M.	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Calif.	500—423
KQP	Apple City Radio Club,	Hood River, Ore.	10—360
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Pa.	250—360
KQW	Chas. D. Herrold,	San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—275
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KSS	Prest & Dean Radio Co. & Radio Research Society of	Long Beach, Calif.	20—360
KTW	First Presbyterian Church,	Seattle, Wash.	750—360
KUO	Examiner Printing Co.,	San Francisco, Calif.	150—360
KUS	City Dye Works & Laundry Co.,	Los Angeles, Calif.	100—360
KUY	Coast Radio Co.,	El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co.,	Stockton, Calif.	100—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	500—360
KXD	Modesto Herald Publishing Co.,	Modesto, Calif.	5—252
KYQ	Electric Shop,	Honolulu, Hawaii	20—360
KYW	Westinghouse Electric & Mfg. Co.,	Chicago, Ill.	1000—536
KZM	Preston D. Allen,	Oakland, Calif.	50—360
KZN	The Desert News,	Salt Lake City, Utah	500—360
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.	50—360
WAAB	Valdemar Jensen,	New Orleans, La.	100—268
WAAC	Tulane University,	New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal,	Chicago, Ill.	200—286
WAAM	I. R. Nelson Co.,	Newark, N. J.	250—263
WAAN	University of Missouri,	Columbia, Mo.	50—254
WAAW	Omaha Grain Exchange,	Omaha, Neb.	200—360
WABA	Lake Forest College,	Lake Forest, Ill.	100—266
WABB	Dr. John B. Lawrence,	Harrisburg, Pa.	10—266
WABD	Parker High School,	Dayton Ohio	10—283
WABE	Young Men's Christian Association,	Washington, D. C.	100—283
WABG	Arnold Edwards Piano Co.,	Jacksonville, Fla.	10—275
WABH	Lake Shore Tire Co.,	Sandusky, Ohio	20—240
WABI	Bangor Railway & Electric Co.,	Bangor, Maine	50—240
WABK	First Baptist Church,	Worcester, Mass.	10—252
WABL	Connecticut Agricultural College,	Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co.,	Saginaw, Mich.	100—254
WABN	Ott Radio, Inc.,	LaCrosse, Wis.	250—244
WABO	Lake Ave. Baptist Church,	Rochester, N. Y.	10—252
WABP	Robert F. Weinig,	Dover, Ohio	100—266
WABQ	Haverford College Radio Club,	Haverford, Pa.	50—261
WABR	Scott High School,	Toledo, Ohio	50—270
WABS	Essex Manufacturing Co.,	Newark, N. J.	50—244
WABT	Holliday-Hall,	Washington, Pa.	100—252
WABU	Victor Talking Machine Co.,	Camden, N. J.	100—226
WABV	John H. De Witt,	Nashville, Tenn.	20—263
WABW	College of Wooster,	Wooster, Ohio	20—234
WABX	Henry B. Joy,	Mount Clemens, Mich.	150—270
WABY	John Magaldi, Jr.,	Philadelphia, Pa.	50—242
WABZ	Coliseum Place Baptist Church,	New Orleans, La.	50—263
WBAA	Purdue University,	West Lafayette, Ind.	250—360
WBAD	Sterling Electric Co.,	Minneapolis, Minn.	100—360

(*Continued from page* 1252)

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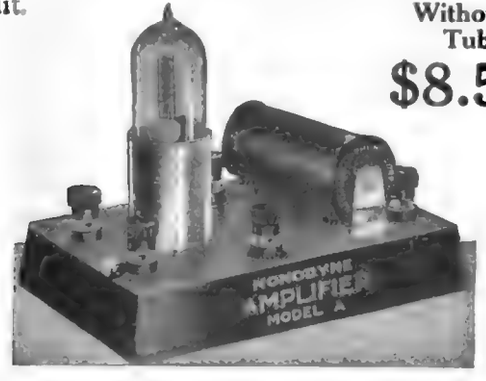

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Radio Broadcast

(*Continued from page 1252*)

Call Letters	Name	Location	Power & Wave Length
WHK	Radiovox Co. (Warren R. Cox),	Cleveland, Ohio	100—360
WHN	George Schubel, Loew's State	Theatre Bldg., New York, N.Y.	100—360
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Ocean City, N. J.	10—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox-River-Valley Radio Co.,	Neenah, Wis.	20—224
WIAK	Journal-Stockman Co.,	Omaha, Neb.	200—278
WIAO	School of Engineering of	Milwaukee, Milwaukee, Wis.	100—360
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAR	Paducah Evening Sun,	Paducah, Ky.	100—360
WIAS	Home Electric Co.,	Burlington, Iowa	100—360
WIAU	American Trust & Savings	Bank, Le Mars, Iowa	20—360
WIK	K & L Electric Co.,	McKeesport, Pa.	100—234
WIL	Continental Electrical Supply	Co., Washington, D. C.	10—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAD	Jackson's Radio Engineering	Laboratories, Waco, Texas	150—360
WJAF	Muncie Press & Smith Electric	Co., Muncie, Ind.	10—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—360
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kan.	100—360
WJAR	The Outlet Co. (J. Samuels &	Bro.), Providence, R. I.	500—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	250—360
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	1000—273
WJD	Denison University,	Granville, Ohio	50—229
WJH	Wm. P. Boyer Co.,	Washington, D. C.	50—273
WJX	De Forest Radio Telephone &	Telegraph Co., New York, N. Y.	500—360
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	100—268
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	200—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	500—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKAY	Brenau College,	Gainesville, Ga.	10—280
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	100—360
WLAG	Cutting & Washington Radio	Corp., Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	100—234
WLAJ	Waco Electrical Supply Co.,	Waco, Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	100—360
WLAL	Naylor Electrical Co. (Sim	Naylor), Tulsa, Okla.	100—360
WLAP	W. V. Jordon,	Louisville, Ky.	15—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—283
WLAV	Electric Shop,	Pensacola, Fla.	15—254
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnam Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	5—360
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma City, Okla.	100—360
WMAC	Clive B. Meredith,	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—360
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAP	Utility Battery Service,	Easton, Pa.	150—246
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAW	Wahpeton Elec. Co.,	Wahpeton, N. Dak.	50—254
WMAY	Kingshighway Presbyterian	Church, St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	50—268
WMC	Commercial,	Memphis, Tenn.	500—500
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	50—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	100—360
WNAL	R. J. Rockwell,	Omaha, Neb.	20—266
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	100—286
WNAP	Wittenberg College,	Springfield, Ohio	100—231
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	10—360
WNAR	C. C. Rhodes,	Butler, Mo.	20—231
WNAS	Texas Radio Corp. & Austin	Statesman, Austin, Texas	100—360
WNAT	Lennig Bros. Co. (Fred'k Lennig),	Philadelphia, Pa.	250—360
WNAV	People's Telephone & Telegraph	Co., Knoxville, Tenn.	500—236
WNAW	Peninsular Radio Club,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNJ	The Shotton Radio Mfg. Co.	Inc., Albany, N. Y.	55—360
WOAC	Maus Radio Co.,	Lima, Ohio	50—266
WOAD	Friday Battery & Elec. Co.,	Sigourney, Iowa	20—360
WOAE	Midland College,	Fremont, Neb.	20—360
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAG	Apollo Theatre (Belvidere	Amusement Co.), Belvidere, Ill.	100—273
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	100—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAL	Wm. E. Woods,	Webster Groves, Mo.	500—229
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	150—360
WOAO	Lyradion Mfg. Co.,	Mishawaka, Ind.	50—360
WOAP	Kalamazoo College,	Kalamazoo, Mich.	50—283
WOAR	Henry P. Lundskow,	Kenosha, Wis.	50—229
WOAT	Boyd M. Hamp,	Wilmington, Del.	50—360
WOAV	2nd Battalion, 112th Inf. P. N.	G., Erie, Pa.	100—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument	Pottery Co.), Trenton, N. J.	500—240
WOC	The Palmer School of Chiro-	practic, Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	100—360
WOK	Pine Bluff Co.,	Pine Bluff, Ark.	500—360
WOO	John Wanamaker,	Philadelphia, Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bur-	eau, Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	200—360
WPAH	Wisconsin Dept. of Markets,	Waupaca, Wis.	500—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	10—268
WPAK	North Dakota Agricultural Col-	lege, Agricultural College, N. D.	50—360
WPAL	Avery & Loeb Electric Co.,	Columbus, Ohio	100—286
WPAM	Auerbach & Guettel,	Topeka, Kan.	100—360

(*Continued on page 1256*)

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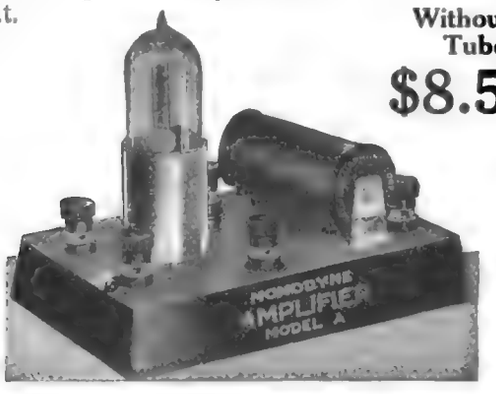

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TO Practical Men and Electrical Students

Yorke Burgess, founder and head of the famous electrical school bearing his name, has prepared a pocket-size note book for the practical man and those studying electricity. It contains drawings and diagrams of electrical machinery, over two hundred formulas for calculations, and problems worked out showing how the formulas are used. This data taken from his personal note book, which was made while on different kinds of work, will be found of value to anyone engaged in the electrical business.

The drawings of connections for electrical apparatus include Motor Starters and Starting Boxes, Overload and Underload Release Boxes, Reversible Types, Elevator Controllers, Tank Controllers, Starters for Printing Press Motors, Automatic Controllers, Variable Field Type, Controllers for Mine Locomotives, Street Car Controllers, Connections for reversing Switches, Motor and Dynamo Rules and Rules for Speed Regulation. Also, Connections for Induction Motors and Starters, Delta and Star Connections and Connections for Auto Transformers, and Transformers for Lighting and Power Purposes. The drawings also show all kinds of lighting circuits, including special controls where Three and Four Way Switches are used.

The Work on Calculations consists of Simple Electrical Mathematics, Electrical Units, Electrical Connections, Calculating Unknown Resistances, Calculation of Current in Branches of Parallel Circuits, How to Figure Weight of Wire, Wire Gauge Rules, Ohm's Law, Watt's Law, Information regarding Wire used for Electrical Purposes, Wire Calculations, Wiring Calculations, Illumination Calculations, Shunt Instruments and How to Calculate Resistance of Shunts, Power Calculations, Efficiency Calculations, Measuring Unknown Resistances, Dynamo and Dynamo Troubles, Motors and Motor Troubles, and Calculating Size of Pulleys.

Also Alternating Current Calculations in finding Impedance, Reactance, Inductance, Frequency, Alternations, Speed of Alternators and Motors, Number of Poles in Alternators or Motors, Conductance, Susceptance, Admittance, Angle of Lag and Power Factor, and formulas for use with Line Transformers.

The book, called the "Burgess Blue Book," is published and sold by us for one dollar ($1.00) per copy, postpaid. If you wish one of the books, send us your order with a dollar bill, check or money order. We know the value of the book and can guarantee its satisfaction to you by returning your money if you decide not to keep it after having had it for five days.

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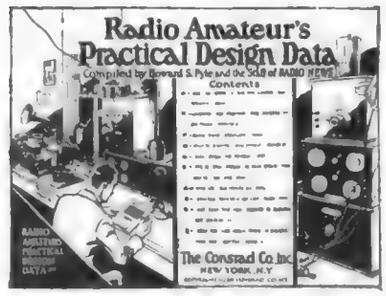
724 Cass St., CHICAGO, ILLINOIS

RADIO BROADCAST

(*Continued from page* 1254)

Call Letters	Name	Location	Power & Wave Length
WPAP	Theodore D. Phillips,	Winchester, Ky.	35—360
WPAQ	General Sales & Engineering Co.,	Frostburg, Md.	10—360
WPAT	St. Patricks Cathedral,	El Paso, Texas	20—360
WPAU	Concordia College,	Moorhead, Minn.	20—360
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	10—273
WPG	Nushawg Poultry Farm,	New Lebanon, Ohio	50—234
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—360
WQAC	E. B. Gish,	Amarillo, Texas	100—360
WQAD	Whitall Electric Co.,	Waterbury, Conn.	50—242
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio	5—240
WQAH	Brock-Amerson Electrical Eng. Co.,	Lexington, Ky.	10—254
WQAI	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—283
WQAN	Scranton Times,	Scranton, Pa.	50—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Texas	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAV	Huntington & Guerry (Inc.),	Greenville, S. C.	15—258
WQAW	Catholic University,	Washington, D. C.	5—236
WQAX	Radio Equipment Co.,	Peoria, Ill.	100—360
WRAA	Rice Institute,	Houston, Texas	200—360
WRAD	Taylor Radio Shop,	Marion, Kan.	10—248
WRAF	The Radio Club (Inc.),	Laporte, Ind.	20—224
WRAH	Stanley N. Read,	Providence, R. I.	15—231
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAM	Lombard College,	Galesburg, Ill.	250—244
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—236
WRAO	St. Louis Radio Service Co.,	St. Louis, Mo.	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—242
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Flexons Garage,	Gloucester City, N. J.	100—268
WRAY	Radio Sales Corp.,	Scranton, Pa.	100—280
WRAZ	Radio Shop of Newark (Herman Lubinsky),	Newark, N. J.	50—233
WRC	Radio Corp. of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	20—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N. Y.	150—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence R. I.	100—261
WSAG	Loren V. Davis and George Prestman, Sr.,	St. Petersburg, Fla.	10—244
WSAH	A. G. Leonard, Jr.,	Chicago, Ill.	500—248
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	250—360
WSAL	Franklin Electric Co.,	Brookville, Ind.	50—246
WSAN	Allentown Radio Club,	Allentown, Pa.	10—229
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	10—254
WSAT	Donohoo-ware Hardware Co.,	Plainview, Texas	20—268
WSAW	John J. Long, Jr.,	Canadaigua, N. Y.	100—275
WSAX	Chicago Radio Lab.,	Chicago, Ill.	20—268

(*Continued on page* 1258)


Radio Amateur's Practical Design Data
Compiled by Howard S. Pyle and the Staff of RADIO NEWS
Contents
The Consrad Co Inc
NEW YORK, N.Y.

Practical RADIO Design Data For The AMATEUR

Don't build your Radio Set without *KNOWING*—Howard S. Pyle, U. S. Assistant Radio Inspector, and the staff of RADIO NEWS has compiled for the Radio Amateur a complete selection of nineteen clear, concise and accurate data sheets that are expressly designed to save TIME, TROUBLE and MONEY.

The tables, information and general data in this compilation are of real reference value for use when building your set. The tables give methods for the calculation of the Measurements of Inductances, Capacity Wave Lengths, Resistance and Capacity of Antennae, etc. There are also concise diagrams and information on several of the most efficient transmitting and receiving circuits used by amateurs.

CONTENTS OF ENVELOPE

No.

1—Measurement of Capacity (Substitution Method).
2—Measurement of Inductance of a Coil or Circuit (Two Methods).
3—Measurement of Distributed Capacity of an Inductance.
4—Measurement of Fundamental Wavelengths of Antenna (Three Methods).
5—Measurement of Wavelength of Distant Transmitting Station Calibration of a Receiving Set.
6—Measurement of Effective Antenna Capacity.
7—Measurement of Antenna Inductance and Efficiency Capacity.
8—Measurement of Antenna Resistance.
54—Proper Filtration of the D.C. Plate Supply.
55—Hartley Circuit Employing Full Wave Self Rectification.
56—Navy Standard Regenerative Receiving Circuit.
57—Five Watt C.W. Transmitter with Synchronously Rectified A.C. Plate Supply Source.
58—The Reinartz Tuner.
59—A 15 Watt C.W. Transmitter.
60—A Spark coil I.C.W. Transmitter.
61—Wavelengths of Inductance Coils.
100—Table giving Oscillation Constant and Frequency, for Wavelengths between 200 and 20,000 meters. (L.C. in Microhenries and Microfarads.)
101—Table giving Oscillation Constant and Frequency, for Wavelengths between 200 and 20,000 meters. (L.C. in Centimeters and Microfarads.)
102—Antenna Characteristics.

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Are YOU One of the 95% Who Suffer from Sick Nerves?

Millions of people are today only half alive and don't know it! They suffer from obscure ills, worry about imaginary troubles, find it hard to concentrate and easily fall a prey to diseases that rob them of their vital powers—all as a result of continuous neglect of their nerves. Bernarr Macfadden, in a wonderful new book which you can obtain free, shows how to recharge your under-nourished nerves and how to acquire glowing health and youthful vitality by following a few easy, natural rules. No medicines, drugs or self-denials, no exhausting exercises or disagreeable diets!

DO YOU worry and fuss over non-essentials? Do you get excited easily? Do you blush readily? Is your memory weak or your eyesight failing? Are your hands and feet cold? Are you troubled with constipation or other stomach troubles? Are you pale? Is your complexion blotched? Is your hair falling? Have you occasional headaches and dizzy spells? Are you troubled with insomnia and too many dreams? Are you impatient—emotional, quick to show your joy or sorrow?

These are only a very few of the signs that show unhealthy nerves, and if you neglect them you will slowly but surely head for the same disastrous condition that is now bringing misery to thousands of people.

Many a promising career and many a happy home has been ruined by some impulsive word or act. Many a social position has been irretrievably lost by some trifling indiscretion or error of judgment—due entirely to unstable nerves. To think that one marriage in every eleven ends in divorce! And to think that 95% of all the misery of the unhappily married is due to nothing more than irritated nerves. When a man loses his temper and flares up in excitement; when a woman begins to nag, fret and worry; when a child becomes unruly or shy—it's simply a case of nerve exhaustion.

It is a pity that so very few people really know how to keep their nerves sound and healthful. How much misery could be avoided, how much unhappiness could be changed to joy if the countless numbers of people who now overlook the little signs of nervous exhaustion could be made to see the folly of their neglect.

It is now just as easy to have sound, healthy nerves as it is to have clean, strong teeth and vigorous muscles! Without drugs or medicines—without tedious, exhausting exercises or enforced hateful diets—without doing anything that isn't pleasant and delightful, you can now recharge your undernourished nerves and live a full, vibrant life that will help you to achieve a glorious business and social success.

Based on his many years of experience as a physical culture expert, Bernarr Macfadden has picked out and set down in writing certain simple, easy-to-follow rules that have helped thousands of men and women to regain their lost nervous energy and to acquire glowing health and youthful vitality. He calls his wonderful book, "Strengthening Weak Nerves." You can obtain a copy without extra charge.

If you follow Bernarr Macfadden's advice faithfully, you will be overjoyed at the results. You'll look better and feel better than you did in years; you will have greater endurance, a keener appetite and a happier outlook on life than you ever had before. You will banish headaches, worries, constipation. Your complexion will become clearer, your eyesight stronger, and you will gradually build up a vigorous body that will be able to resist nearly every ailment that is at present sapping the energy of thousands.

The book is written in an easy, fascinating style. There is nothing difficult to understand. You'll enjoy every page because it shows you the way to glowing health and vigor. The knowledge you'll gain from reading Bernarr Macfadden's book will help you throughout your entire life, for it will build for you a solid foundation for your future success and happiness.

FREE

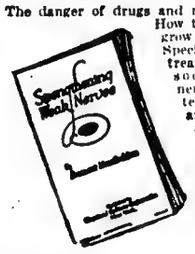
Amazing New Book

"STRENGTHENING WEAK NERVES"

By Bernarr Macfadden

Every reader of Physical Culture can now obtain the wonderful book without extra charge. Here are some of its contents:

What to eat and drink for nerve energy.
Causes of fatigue.
How to prevent loss of nerve force.
How to restore nervous health.
How internal and external bathing builds healthy nerves.
How to breathe deeply.
Exercises that stimulate weak nerves.
The danger of drugs and nerve tonics.
How to relax and grow strong.
Special spine treatment that soothes the nervous system. Mental and emotional influences that build healthy nerves.
Ten simple rules for strengthening the nervous system.



This Splendid Book Sent Free With This Offer

The advice which Bernarr Macfadden has set down in his wonderful book, "Strengthening Weak Nerves," is invaluable to every man and woman.

But if you act quickly you can now obtain a copy absolutely without extra charge. "Strengthening Weak Nerves" is sent free with a year's subscription to Physical Culture, the magazine that is showing thousands of people the way to glorious health. Every month Physical Culture comes to you chock full of copious illustrations—powerful editorials—exercise articles—food articles—health articles—weight control—personal health problems—thrilling fiction throbbing with life—superb rotogravure section showing physically perfect men and women and beautifully developed babies—all glorifying a healthy mind in a healthy body.

If you're overweight you'll find articles on how to reduce; if you're too thin you learn how to put on many pounds of good, solid muscle. If you're suffering from constipation, or a poor, sallow complexion, you'll find even in one single issue wonderful authoritative advice that will bring you renewed vigor and a radiant complexion.

A Few of the Symptoms of Sick Nerves

1. Excitement and mental depression.
2. Headaches, dizziness, deafness.
3. Weakness of memory.
4. Disturbed sleep-troubled dreams.
5. Blurring of sight.
6. Ringing in the ears.
7. Feeling of numbness.
8. Cold hands or feet. Flushings and sweats.
9. Muscular weakness, lack of endurance.
10. Dyspepsia, other stomach troubles.
11. Pains around heart.
12. Spells of irritability.
13. Knee jerks.
14. Strange fears.
15. Continuous flow of thought preventing sleep at night.
16. Very emotional—quick to show joy or sorrow.
17. Gloomy—pessimistic, always looking on the dark side of things.

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Physical Culture is sold at the newsstands at 25c a copy. But for a limited time you can obtain a full six months' subscription—6 big issues—in addition to Bernarr Macfadden's book, "Strengthening Weak Nerves"—all for $1.50.

If you want healthy nerves and vigorous body—if you want to add at least ten years to your life and enjoy every minute of it—then mail the coupon below. The book, "Strengthening Weak Nerves," will be sent you at once with the first issue of Physical Culture. Mail the coupon now before this remarkable offer is withdrawn.

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Radio Broadcast

(*Continued from page* 1256)

Call Letters	Name	Location	Power & Wave Length
WSAY	Irving Austin (Port Chester Chamber of Commerce),	Port Chester, N. Y.	100—233
WSAZ	Chase Electric Shop,	Pomeroy, Ohio	50—258
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSL	J. & M. Electric Co.,	Utica, N. Y.	100—273
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	10—248
WTAC	Penn. Traffic Co.,	Johnstown, Pa.	150—360
WTAF	Louis J. Gallo,	New Orleans, La.	20—268
WTAG	Kern Music Co.,	Providence, R. I.	10—258
WTAH	Carmen Ferro,	Belvidere, Ill.	10—236
WTAJ	The Radio Shop,	Portland, Me.	10—236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10—252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio	1000—390
WTAN	Orndoff Radio Shop,	Mattoon, Ill.	100—240
WTAP	Cambridge Radio & Elec. Co.,	Cambridge, Ill.	50—242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100—226
WTAR	Reliance Elec. Co.,	Norfolk, Va.	100—280
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500—286
WTAT	Edison Electric Illuminating Co.	Boston, Mass. (Portable)	100—244
WTAU	Ruegg Battery and Electric Co.,	Tecumseh, Neb.	10—360
WTAW	Agricultural & Mechanical College,	College Station, Texas.	50—280
WTAX	Williams Hardware Co.,	Streator, Ill.	50—231
WTAY	Iodar-Oak Leaves Broadcasting Station,	Oak Park, Ill.	15—226
WTAZ	Thomas J. McGuire,	Lambertville, N. J.	15—283
WTG	Kansas State Agricultural College,	Manhattan, Kansas	1000—485
WWAB	Hoenig, Swern & Co. (John Rasmussen),	Trenton, N. J.	10—226
WWAC	Sanger Bros.,	Waco, Texas	50—360
WWAD	Wright & Wright, Inc.,	Philadelphia, Pa.	100—360
WWAE	Alamo Dance Hall (L. J. Crowley),	Joliet, Ill.	500—227
WWAF	Galvin Radio Supply Co.,	Camden, N. J.	100—236
WWAO	Michigan College of Mines,	Houghton, Mich.	250—244
WWI	Ford Motor Co.,	Dearborn, Mich.	50—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517
WWL	Loyola University,	New Orleans, La.	100—280

The Heavens In April

By ISABEL M. LEWIS, M.A.

(*Continued from page* 1224)

constellation of Ursa Major, the Greater Bear, and by the inconspicuous groups of Lynx and Camelopardus. After being hidden from view for the greater part of the winter by trees, houses or other obstructions that cut off our view of an object when it lies close to the horizon, the Big Dipper is now swinging around to a high position above the pole and will be seen to the best advantage from now on through the spring and summer. In speaking of the Big Dipper it is well to bear in mind that it is but a part of the constellation of Ursa Major. To the west and south of the Dipper are a number of stars of the third and fourth magnitude that belong to the constellation of Ursa Major. In fact they mark the head and forepaws of the bear. The seven stars of the Dipper mark the back and the ridiculously long tail of the creature who differs in this respect from all others of his kind, unless we except the Lesser Bear of similar form which lies near by with the tip of the tail marked by the pole-star, Polaris.

(*Continued on page* 1260)

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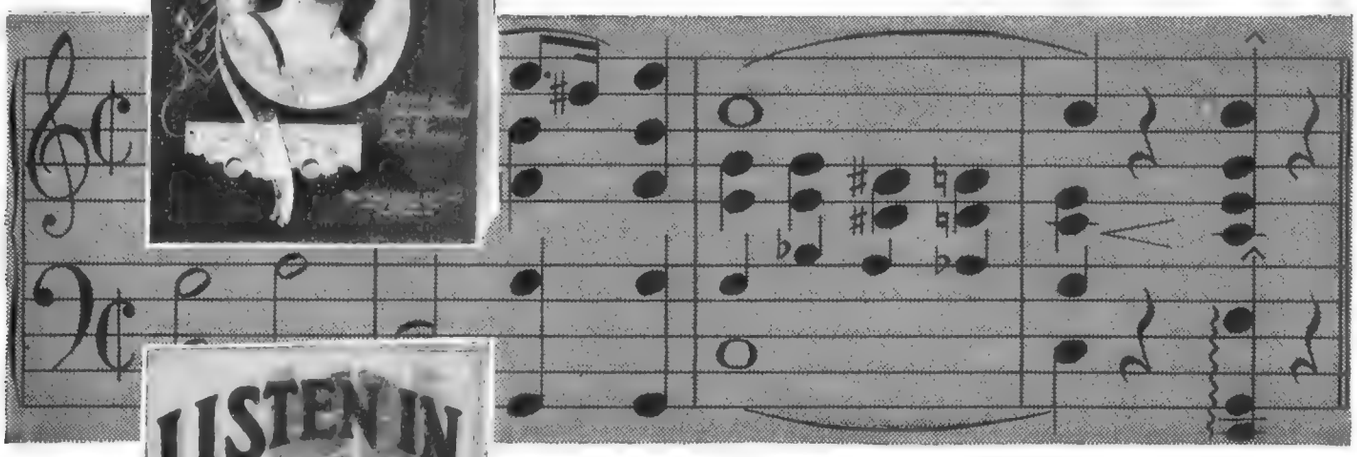

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The Heavens in April

(*Continued from page* 1258)

The North American Indians, we are told, also saw in this constellation a bear, but the three stars of the tail were to them the hunter and his dogs. Although this constellation seems to have been known universally in all ages and all lands as The Bear, it has also been known, particularly in England, as The Wain, and frequently as The Plow, the three stars in the handle of the Dipper representing in this case the Plow-Oxen. Among the Romans it was often referred to as The Seven Plow-Oxen. In early England it was Arthur's Wain and later Charles' Wain and, today, usually The Wain or The Plow.

A DOUBLE STAR

The middle star in the handle of the dipper, Mizar, and its nearby Alcor, a star of the fourth magnitude, is a well-known naked eye double star that is popularly known as the horse and his rider. In Germany Alcor is Hans, the wagoner, and in England, Jack on the middle horse. Anyone with fairly good eyesight should have no difficulty in making out this fairly bright companion of Mizar. To the Arabs the ability to separate the two stars was a test of eyesight.

Close to the meridian at this time and a little to the southeast of the zenith is Leo, one of the most conspicuous of the spring groups. It can be easily recognized by its characteristic Sickle. The star at the end of the handle is the first-magnitude star Regulus, or as it has been popularly called, Cor Leonis. It is one of the white, hydrogen stars and its distance from the earth is about fifty light years. Some distance to the east of Regulus is the second-magnitude star Denebola, which marks the tip of the lion's tail. This star makes with Arcturus, the orange-hued giant star now visible in the northeast, and with the beautiful white star Spica in Virgo, in the southeast, a huge equilateral triangle the appearance of which may be taken as announcing the arrival of spring.

THE PLANETS VISIBLE

The planet Venus is now setting about nine P. M. the first of the month and is a most beautiful and conspicuous object in the western sky in the early evening hours. It reaches its greatest eastern elongation on the twenty-second of April, when its angular distance from the sun is a little over forty-five degrees. It will be in the constellation of Taurus throughout the month and its position is indicated on the chart for the first, middle and last of the month. It is still increasing in brightness and will not reach its greatest brilliancy until the latter part of May.

Mercury will reach its greatest elongation east of the sun on the sixteenth of April. It will then be about twenty degrees east of the sun and should be visible in the northwest for a short time immediately after sunset as a bright star of the first magnitude.

Mars is in the constellation of Sagittarius the first of the month and passes into Capricornus before the end of April. It is still visible in the east in the early morning hours and on the thirteenth of the month is on the meridian at sunrise.

Jupiter is in the constellation of Scorpio a little to the east of Antares. It now rises before midnight but is not visible at the time for which the chart is given.

Saturn is now in Virgo a few degrees east of Spica. Its position is given on the chart for April fifteenth. On the nineteenth it will be in opposition to the sun. It will then rise at sunset and be on the meridian at midnight.

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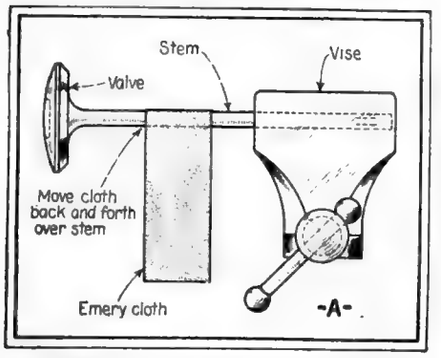
Motor Hints

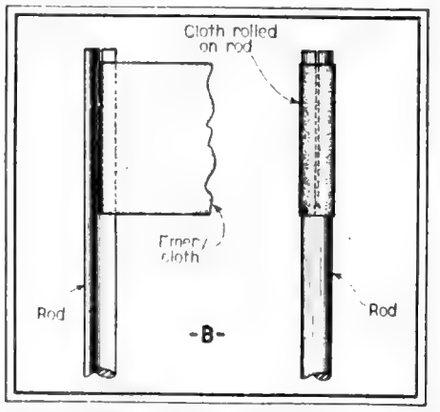
Valve grinding, adjustments, troubles and cures

BY TOM C. PLUMRIDGE

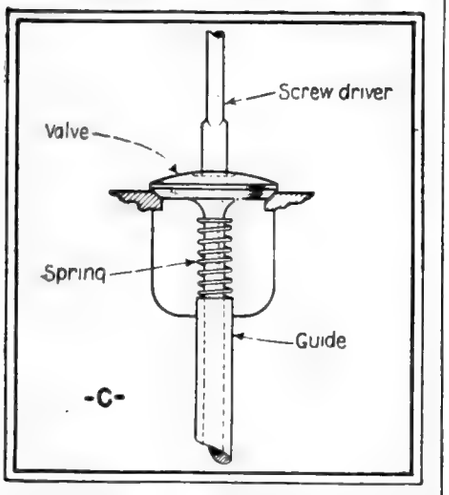
Automotive Expert



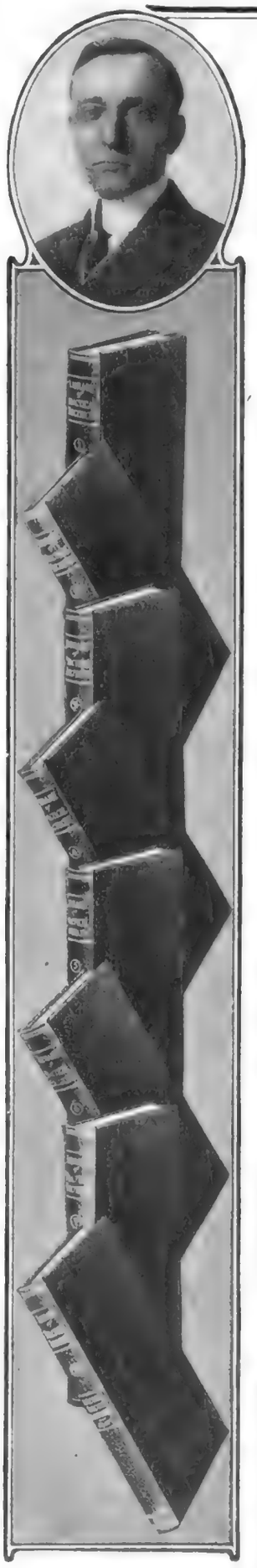
The automobile engine must have good compression to have power, and to get good compression the valves must have a good seat. The exhaust valves are the first to give trouble, because they are subject to the heat of the hot gases, and they are the ones that need most grinding. The stems should be polished first. Emery cloth is the best thing to use and the method for polishing them is shown in Sketch A.



The next operation is to clean out the guides. Use a good tool for this as shown above. Split a thin rod down the center and wind a piece of emery cloth around it; but first insert the cloth in the slit so that it will not slip. Place the tool in the guide and work it back and forth until all of the carbon is removed from the guide; after this is completed the valve is ready for grinding.



Before grinding place a light spring under the valve so that when the pressure is released the valve will be raised off the seat and the grinding compound will be allowed to get under the seat. Place a little of the grinding compound on the face of the valve and put it in place. Press lightly on the screwdriver and rotate the valve back and forth. Occasionally release the pressure, as already stated. Sketch C will show how this is done. When the valve and seat show a continuous ring around them the valve is ground in. Wash valves and guides thoroughly with gasoline before assembling.



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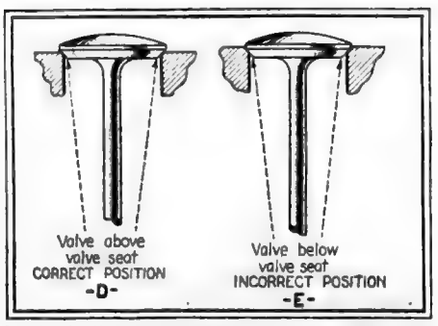
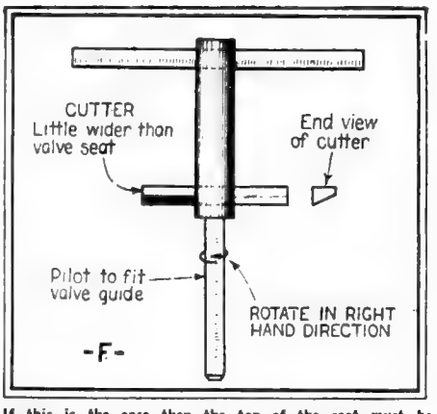
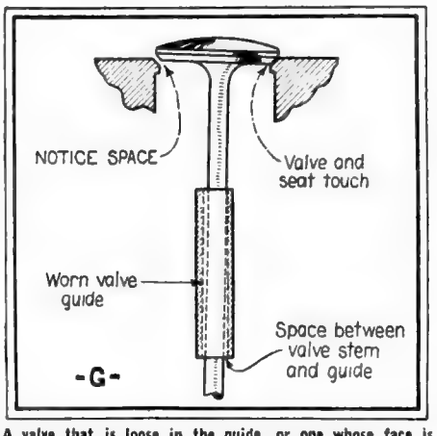


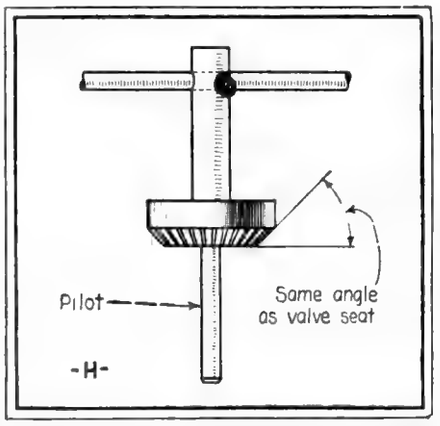
A valve in its correct position will stand a little above the seat as shown in sketch D but excessive grinding will often bring the valve below the top of the seat as shown at E.



If this is the case then the top of the seat must be recessed until the valve again stands above the seat. A tool for this is shown in sketch F. When making this tool be sure that the pilot fits the valve guide snugly.



A valve that is loose in the guide, or one whose face is not true with the seat will allow the valve to touch on one side of the seat first and then drop over on to the other side; this causes a clicking noise which is hard to locate. Sketch G shows this condition.



There is another reason why valve guides should be a good fit. Sometimes the seat will become badly lined and need truing up, and for this purpose a valve re-seating tool should be used. Sketch H.

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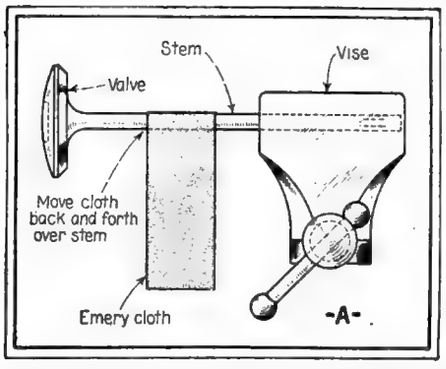
Motor Hints

Valve grinding, adjustments, troubles and cures

BY TOM C. PLUMRIDGE

Automotive Expert



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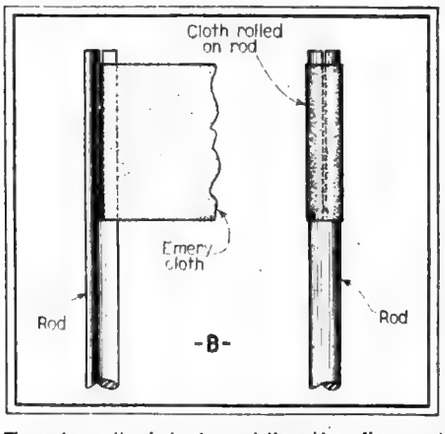
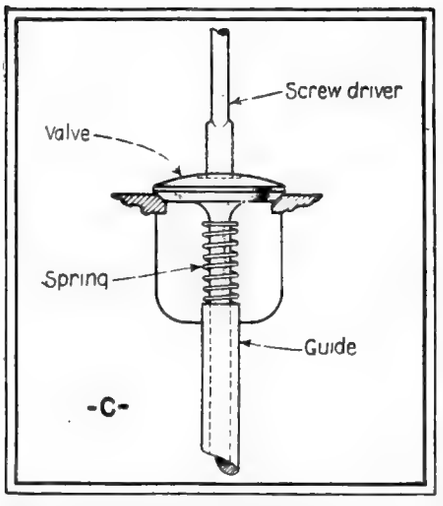


The next operation is to clean out the guides. Use a good tool for this as shown above. Split a thin rod down the center and wind a piece of emery cloth around it; but first insert the cloth in the slit so that it will not slip. Place the tool in the guide and work it back and forth until all of the carbon is removed from the guide; after this is completed the valve is ready for grinding.



Before grinding place a light spring under the valve so that when the pressure is released the valve will be raised off the seat and the grinding compound will be allowed to get under the seat. Place a little of the grinding compound on the face of the valve and put it in place. Press lightly on the screwdriver and rotate the valve back and forth. Occasionally release the pressure, as already stated. Sketch C will show how this is done. When the valve and seat show a continuous ring around them the valve is ground in. Wash valves and guides thoroughly with gasoline before assembling.

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EDITED BY
A. P. PECK,
Associate Member Institute Radio Engrs.

UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular prizes will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" editor, care of Science and Invention.

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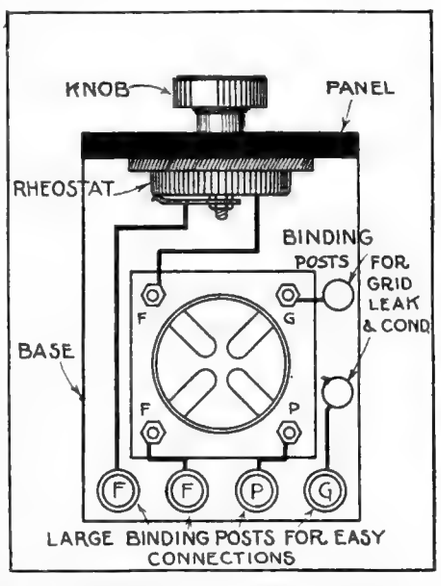

When experimenting with new circuits, much of the fuss and bother of hooking up rheostats and sockets may be eliminated by making up two or three units such as are illustrated above. Connections can be made more easily to the large binding posts than to the small ones usually found on rheostats and sockets. On one of the units, binding posts should be left for a grid leak and condenser so that this unit may be used for the detector. The others need not have this, as they will usually be used as amplifiers. If desired, audio frequency amplifying transformers may be mounted permanently in one or two of these units so that they may be used when desired.

—Leroy Western, Reporter No. 15.

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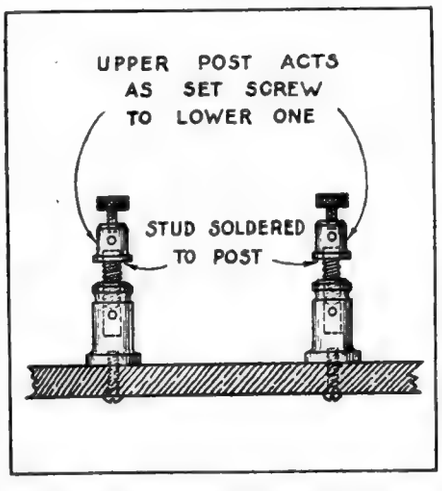

Double binding posts can quickly be made from two single posts by cutting off the head of the thumb screw of one and soldering the stud to the base of the other one. The two posts are then assembled as shown above. Make connections to the bottom one first and then to the top one.

—F. E. D.

(Will the author kindly forward his full name and address? Ed.)

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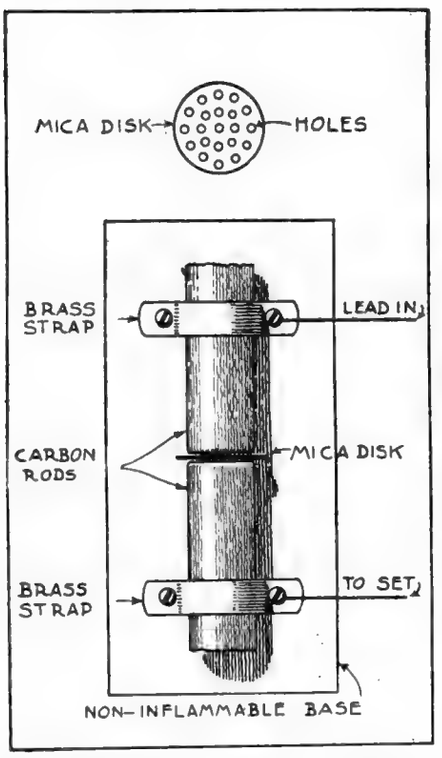

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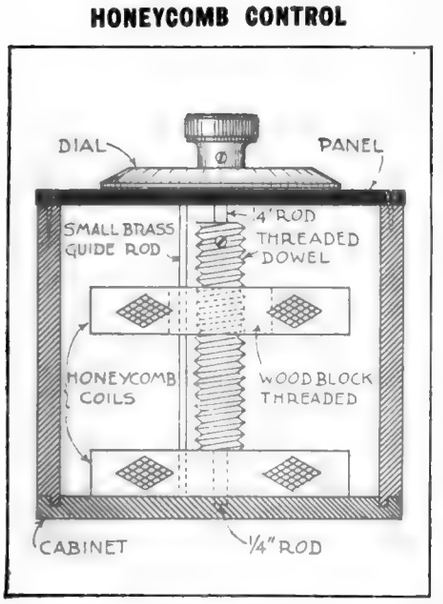
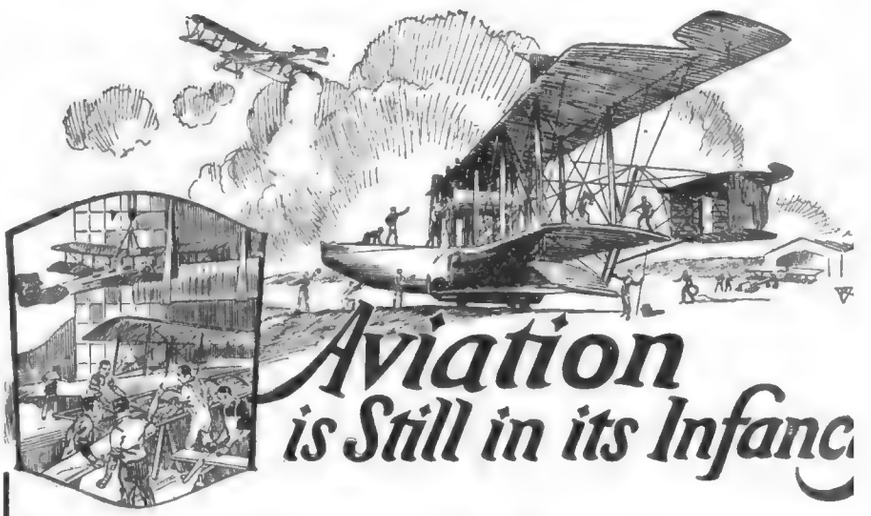
HONEYCOMB CONTROL



If one has access to a wood turning lathe on which threads can be cut, a very good honeycomb coil mounting and regulating device can be made. First, a wooden block is obtained which will just fit within a honeycomb coil and a hole is cut in the center and threaded. A dowel is then threaded with the same size thread. The wooden block with the large hole in the center is then glued within one of the honeycomb coils and a small hole drilled through it for the guide rod. It is advisable to glue another wooden block within the other honeycomb coil which in turn is mounted on the cabinet. The entire assembly is made as shown above and a dial is fastened to the end of the rod. By turning the dial, the threaded dowel will revolve, causing the movable honeycomb coil to move closer to or further away from the stationary coil, depending upon the direction in which the dial is turned.

—F. R. Donahue.

(*Continued on page* 1270)



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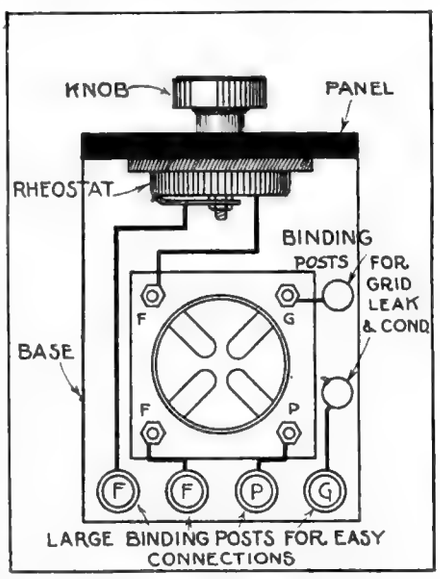

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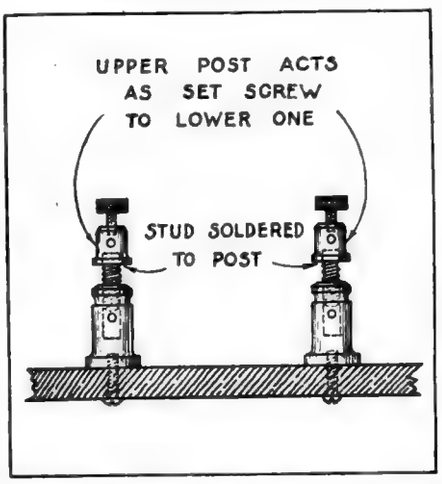

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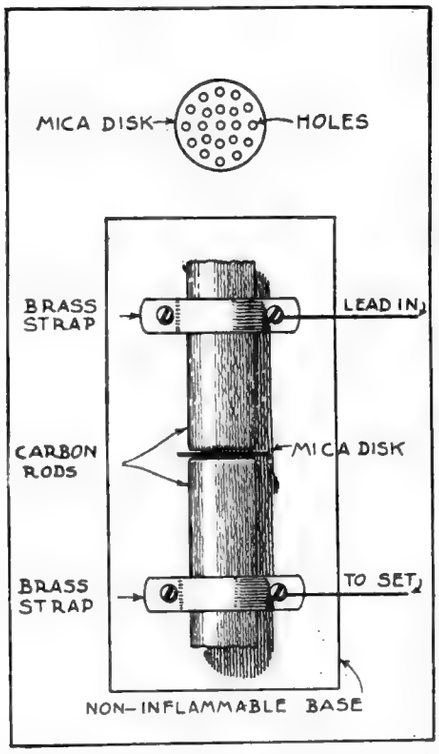

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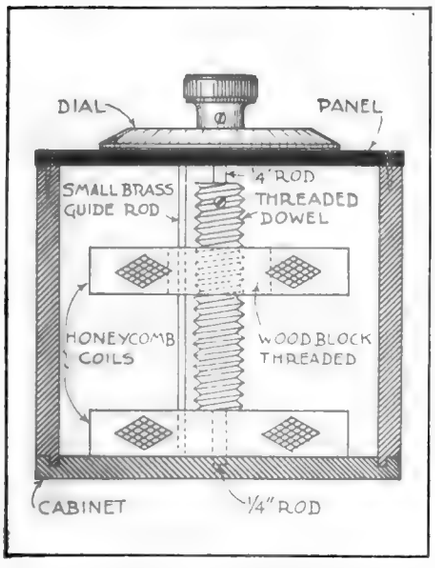

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—F. R. Donahue.

(*Continued on page* 1270)

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ELECTRICAL SWITCH

(787) Carlos Bonilla, Gandia, Spain, has designed a multiple blade switch which will control a number of circuits because of an ingenious blade motion of the switch.

A. Instead of your switch being of particular value, it is a hindrance in ordinary electrical circuits. Only in a very few circuits could this switch be employed. You will note that, at any time, only one of the four circuits could be in operation. With several switches any of them could be thrown in. In addition to that your device is not rigid enough to be continually practical.

We would not suggest your applying for a patent on this device.

LOCK NUT

(788) Thomas George White, Seattle, Wash., has designed a rather complicated lock-nut and bolt combination.

A. Do you think any one would purchase your lock-nut arrangement considering cost of its manufacture? It is a very simple matter to drill two or three holes through a bolt and pass a cotter key through it. With a nut this forms a lock-nut that is quite efficient. Assuming even that your device is superior to the one just mentioned, do you realize what it means to cut a longitudinal groove into each individual bolt to construct the nut as shown? The nut you show is a special type. To construct a key to fit the slot and to tap out the end of the bolt for the reception of a screw which is to hold the key in place would incur another enormous expense. Would you, as a manufacturer, undertake the construction of a device of this nature, when you know that a device which will perform the same duty can be constructed in three complete operations?

The ordinary bolt and nut with an ordinary lock washer may be employed effectively to perform the work of your complicated invention and cost much less.

We most emphatically advise against applying for a patent on this idea because you will find that you cannot effect a sale, try as hard as you will.

ELECTRIC DOOR ALARM

(789) Leslie White, Montrose, Colo., has designed an attachment to be fitted into an ordinary door lock converting it into an electric alarm sounding device without destroying its effectiveness as a lock.

A. The device you have originated is very elaborate in comparison with other devices serving a similar purpose. The writer has seen attachments which could be built for 10c, and could be marketed for less than $1.00, which will do the same work as your system and may be installed with much less trouble. We would surely not advise you to apply for a patent on the system you have advanced, as it is, in reality, not an attachement but a new lock. The process of drilling holes through the metal casing of a lock after removing it from the door, placing the contact springs in place, aligning them and drilling holes through the door for the wire and inserting insulating bushings is entirely too complicated. This is not the kind of work to which the ordinary housewife is suited and your system should be developed for her, not for the electrician. The latter can install locks of this nature and has them always on hand.

DEMOUNTABLE TIRE RIM

(790) W. G. Walsh, Canso, Nova Scotia, requests our advice on a demountable rim for automobiles.

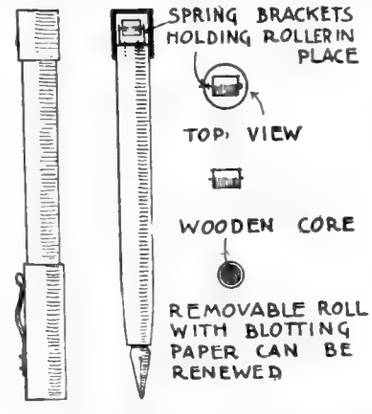
A. It is quite possible that your invention is patentable, but we doubt very much if it would be worth while to patent it. Present day demountable rims are practically standardized. In view of the fact that your rim does not show any marked improvement over other rims, we fail to see why the present rim should be supplanted. A demountable rim is a very hard object to place upon the market unless you have good financial backing. Consequently we would advise against applying for patent. Bear in mind that we do not desire to condemn the idea, but like most inventions of this class, this device would present no possibility of a return for the original investment.

BLOTTING ATTACHMENT FOR FOUNTAIN PENS

(791) R. W. Wensko, Lakewood, Ohio, has designed a blotter for fountain pens in which a small roller made of blotting paper is placed at the end of the cap of a pen. This is to be replaced when saturated with ink.

A. Although at first glance your idea of a small blotting attachment at the end of a fountain pen may have appeared to be a very practical suggestion to yourself, you will note that the roller at the end of this pen would be very small indeed. Being of such a diminutive size, the roller would become clogged with ink in a very short time. It is very difficult also to turn this pen over and roll it along the writing. The rollers as described by you will also be quite expensive, costing much more than a group of blotters.

We frankly believe that this device holds no commercial value whatever, and would not suggest applying for a patent.



A blotting roller for a fountain pen is impractical on account of its diminutive size.

ANNULLING GRAVITY

(792) B. J. I. Cahigh, Oakland, Calif., asks if any one has ever built a machine which will annul gravity.

A. There have been several attempts made to build small machines to annul gravity. One of these in which high frequency currents actually suspended small silver balls was described in this journal. No attempt has been made to build a large machine. We frankly believe that such a device is possible, but the cost of building it together with the cost of experiments bringing it to practicality would be prohibitive. The anti-gravitation railway, designed by Mr. Emile Bachelet, uses alternating currents to produce similar action. If you will make your letter a little more explanatory, we will be glad to give you further advice upon this subject.

VARIO-COUPLER WITH DEAD END SWITCH

(793) F. Fox, Redondo Beach, Calif., requests our advice on a vario-coupler with a fan-switch thereon, the purpose of which is to eliminate dead end losses.

(*Continued on page* 1268)

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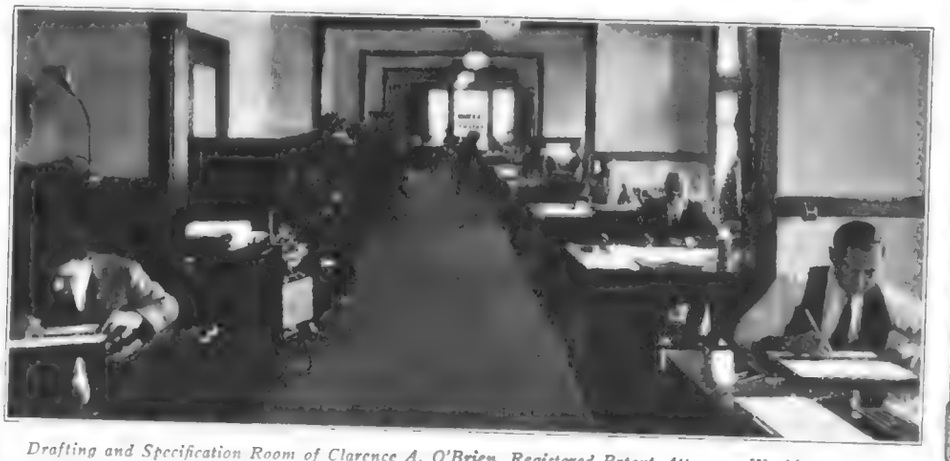

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Patent Advice

(*Continued from page* 1266)

A. Your idea of a vario-coupler does not present any radical departures from or any valuable advantage over other vario-couplers found upon the market, except that there are no dead-end losses in the same. Nevertheless, vario-couplers today have but relatively few turns of wire upon their primaries, and consequently a dead-end switch is not necessary. Your coil presents many difficulties in panel mounting as well as in additional cost of contact points and sector switch, without giving results worth this additional expense.

SELF-WINDING CLOCKS

(794) Paul L. Delp, Kuztown, Pa., requests our advice on a clock which will be wound up by an electric motor when the spring runs down.

A. You have discovered nothing new at all in your system of wiring an ordinary clock in such manner that the moment the spring runs down or its power is nearly exhausted, it is rewound again by an electric motor. This system is as old as the proverbial hills, and is used on many of the large clocks, as well as on many small ones. The power clocks found in the large buildings of New York are all wound by electric motors as are the clocks installed in most offices and buildings. Two dry cells in these latter clocks operate the motor to wind the spring.

PATENT APPLIED FOR!

(795) Arthur H. Esbig, New York City, asks whether he can market a device with the words "patent applied for" or "patent pending," and which of the two terms he should use.

A. Any individual who has filed a patent in the Patent Office, can go ahead and manufacture this article, labeling it "Patent Applied For," and if the serial number has been granted he can label the device "Patent Pending." Any other manufacturer could also make this article at the same time, knowing full well that he was copying the original design. By tedious processes of law this second manufacturer could be restrained from manufacturing the article, and after the patent is granted, suit could be brought against the second party for back royalties. If the second party meanwhile goes out of business or is bankrupt, the first party can recover nothing. If the second party will also enter a similar design for patenting, interference cases may spring up which will result in court action to clear up the matter, costing the first and second party a great deal of money before either one or the other is forced to terms.

PRODUCING DEAFNESS

(796) Charles Fornen, Gainesville, Florida, has stated that he often desired a device which would make him deaf at will, particularly when a cat howls or a trombone starts to play. He has accordingly designed a vacuum cup to be fitted into the ear and asks our advice regarding same.

A. Referring to your suggestion of an appliance to produce deafness at will, we would advise that even though the device may be patentable, and seems to you seemingly practical, it will find no market whatever. Neither you nor I would care to have rubber cups pushed into the ears and then released, forming a vacuum which is applied to a very sensitive organ, where the possibility of creating head noises, rupturing the ear drum, and causing other damages is great. The device would be very uncomfortable and rather messy in operation. It is doubtful if the device would work as sounds are not all conveyed through the ears, and even attempting to stop up the ears by holding the fingers in them will not effect the propagation of sound, or completely destroy its record in the brain.

FARM ELECTRIC LAMP

(797) R. Farnsworth, Rigley, Idaho, has submitted a design for a farm electric table lamp constructed as shown herewith. He asks our advice.

A. Your idea of an electric home light used particularly for farms is of no value whatever. The cost of construction is so great, and the commercial possibilities so small that we do not suggest applying for a patent, nor do we believe that you could even procure a patent upon the suggestion. You have complicated matters to such an extent that the cost of replacement as well as the fussing with them renders their adoption very unlikely.

HAT PINS

(798) F. George, Dark Harbor, Maine, requests our opinion of a hat pin, the design of which is made clear in the answer.

A. We would not suggest patenting any type of hat pin. They are obsolete, passé as it were, and we doubt if they will ever come back. A slight dent at the end of a hat pin will not secure it. Spiral shaft will render it difficult to push the pin through the hair, and to remove the same expeditiously. We would advise you to try your inventive ability, which you have shown to be quite acute, along other lines. Utilitarian devices

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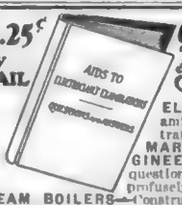

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BOTTLE CAP

(799) B. M. Gritz, Adams, Mass., requests our advice on a bottle cap with a lip which will enable the same to be removed with the fingers.

A. Referring to the attachment to a bottle stopper we are of the opinion that such a device, although slightly practical, is not by any means marketable. Such a bottle stopper requires different types of machines for clamping the same around the head of the bottle. In addition to that, it is expensive to manufacture. This is its greatest drawback, and inasmuch as a cheaper article, which performs this service equally well may be found upon the market, we would strongly advise against applying for a patent upon it.

Scientific Mating

By H. GERNSBACK

Member American Physical Society

(*Continued from page* 1198)

the individuals, physical or sex attraction is lacking.

Second, we have a *Sympathetic test* between the two individuals. In the upper left hand is shown an attendant drawing blood from the hand of the young man or from any other part of the body. The young woman is seen to be equipped with the same apparatus heretofore indicated except that the electrical sphygmograph is not employed. Consequently, muscular contractions and sudden inhalations due to the excitement with the attendant muscular relaxations for sympathy, are recorded on a tape. Unless a certain maximum is reached, it would show that the sympathetic reaction of the girl is not sufficient. The same tests must, of course, be made with the girl in order to give a similar reaction check on the man.

Third, probably more marriages are wrecked by unpleasant *Body odors* than from any other cause. A bad bodily odor or a bad mouth odor may turn love into dislike. In the upper right hand illustration, we have shown where the candidates are made to breathe each other's body odors —not a pleasant performance, but very necessary, if we would not be prudish. It is better to find out these things before we are married than when it is too late.

Fourth, *Nervous disorders* have wrecked a large percentage of marriages. The two mating individuals should under no circumstances be extremely nervous. If the man is calm and the woman very nervous or vice versa, no great harm is done, because Nature tends to equalize opposing forces. The mischief begins when both individuals are extremely nervous. It can then be predicted with certainty that their married life will not work out satisfactorily. In the lower right illustration, we have shown how both individuals are equipped with the same apparatus before described. Then unknown to them, a sudden loud noise, such as the firing of a revolver, is produced. The nervous reaction of the two candidates can be checked up nicely on a tape, and if both show the same reaction, marriage should not take place.

Of course, there are many other tests which can be suggested to complete the testing of the marriage candidates, but the four cited here are probably the fundamental ones and therefore the most important.

Enlarged views of the tambour, manometer and chest device for operating the tambour are also shown.

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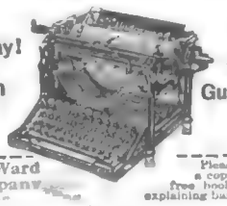

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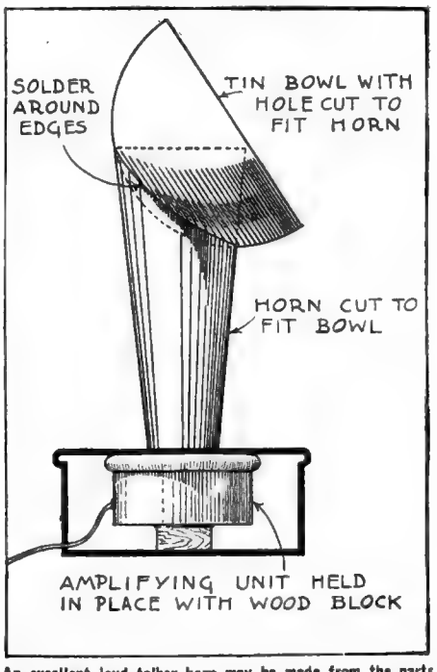
Radio Wrinkles

(*Continued from page* 1265)

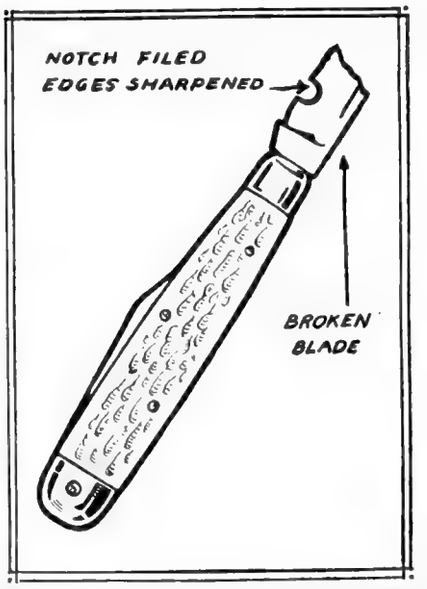
A LOUD TALKER HORN



An excellent loud talker horn may be made from the parts of an old automobile horn. A large bowl made of rather heavy gauge metal, so that it will not vibrate excessively, is first obtained and an oval shaped hole cut in its bottom. It will be noted that the less the horn tends to vibrate, the better will be the quality of music and speech reproduced. The upper end of the horn is then cut to fit the hole in the base of the bowl. A little grinding and cutting will be required here until an exact fit is obtained. The edges of the joint are then soldered. The entire unit may then be painted black so as to present a good appearance. An amplifying unit of any of the well made types is then placed within the part of the horn which formerly held the operating mechanism. The diaphragm of the original horn must, of course, be removed. The amplifying unit is held in place by means of a wood block which is of such a size that the cap of the phone will be held rigidly against the base of the horn. The leads from the phone are to be brought out through a hole in the base.

—Glen F. Stillwell.

WIRE SCRAPER



Many are the nicks which have been put in a perfectly good pocket knife blade by scraping the insulation from wires. Very often a blade is broken in this process. If this happens, the broken blade may still be made to give very good service by grinding a notch in it and filing the edges sharp, as shown above. Even in a knife without a broken blade, such a notch could be placed near the base of one of the blades without interfering with its original purpose. By using this filed notch in connection with the thumb, insulation can be quickly and easily scraped from wire. The sharpened edges of the knife blade will be saved from damage.

—Stanley Robinett.

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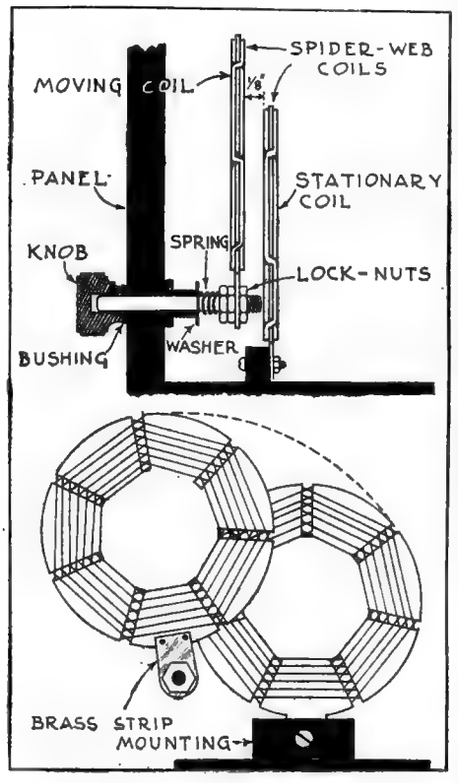
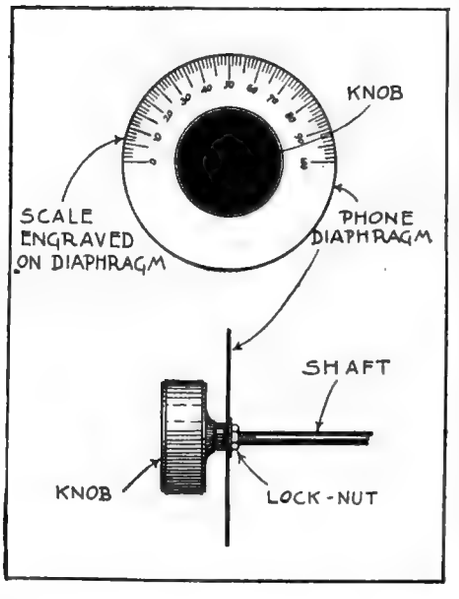
SPIDER-WEB COIL MOUNTING



When spider-web coils are to be mounted back of a panel, the procedure outlined above may be followed. One of the coils is mounted on a block in a stationary position. The other one has fastened to it a piece of fairly heavy brass strip. A hole is drilled in the end of the strip and a short length of brass rod fastened thereto by means of lock nuts. This brass rod passes through a bushing in the panel and a knob is fastened on the outer end. A spring inserted between the lock nuts and a washer on the end of the bushing serves to keep the spider-web coil in the position in which it is set and prevents the possibility of the horizontal distance between the coils varying. —James Williams.

CHEAP DIALS



Old phone diaphragms which have become bent or dented and are no longer useful in their original purposes can be made useful as small dials for rheostats or potentiometers. A scale may be engraved on the diaphragm with a sharp needle and a hole drilled through the center of the dial. The shaft is then passed through and a knob screwed on the outside. A lock nut drawn up on the back of the diaphragm holds the unit rigidly. These dials will present even a better appearance if they are enameled white and the graduations put on with black paint.

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Service

WHAT? WHY? HOW? WHERE?

"I keep six honest, serving men:
(They taught me all I knew):
Their names are WHAT and WHY and WHEN,
and HOW and WHERE and WHO." (Kipling)

WHAT was the Declaration of London? WHAT are consols?
WHY does the date for Easter vary from year to year?
WHEN and by whom was the great pyramid of Cheops built?
HOW can you distinguish a malarial mosquito?
WHERE is Canberra? Zeebrugge? Delhi?
WHO was Mother Bunch? Millboy of the Slashes?

WHEN? WHO?

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The *New International* is the final authority for the Supreme Courts and the Government Printing Office at Washington.

NEW WORDS
Thousands have been added. Can you spell, pronounce, and define them?

Here are samples:

Czecho-Slovak	capital ship
junior college	mirrorscope
Murman Coast	marquisette

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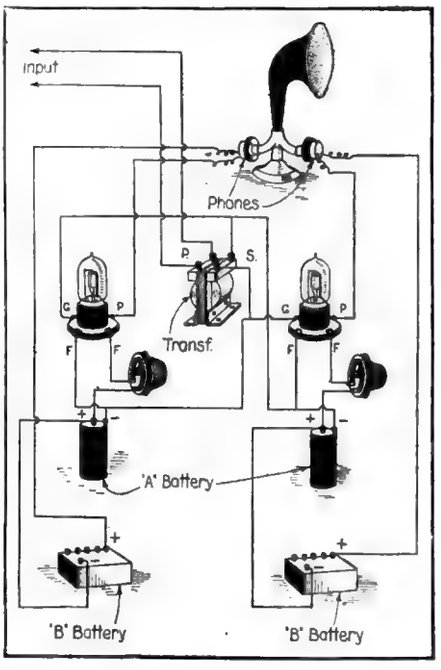
PUSH-PULL AMPLIFIER



Those desiring a push-pull amplifier without going to the expense of buying two push-pull transformers may use this circuit with excellent results. In this circuit dry cell tubes are recommended, as separate "A" and "B" batteries are required. One amplifying transformer of any standard make may be used, connected as shown. It will be noted that when one grid is negatively charged, the other is positively charged, thus giving the true push-pull effect. As one loud speaking phone is required for each tube, those having a pair of loud speaking phones may use it to advantage by connecting the phones as shown and attaching them both to one horn. —C. Fitch.

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90 AMP. HRS.

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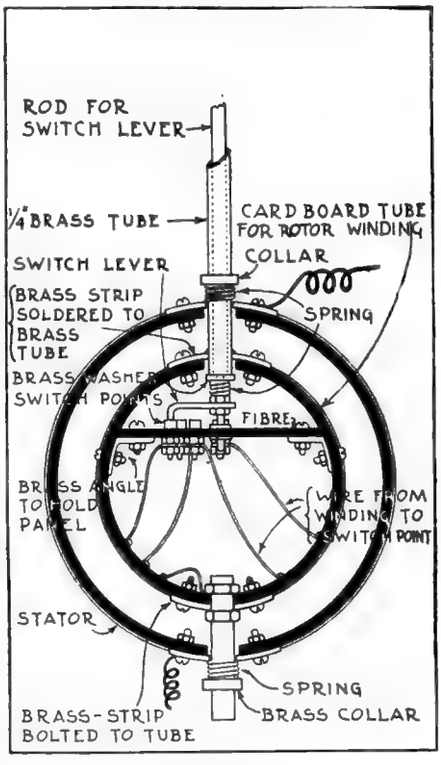
ROTOR MOUNTING



In some circuits it is very desirable to have a tapped rotor. This may readily be accomplished by following the drawing given above. A small panel is placed within the rotor and a switch arm is arranged so that it can be controlled by means of the rod passing through the brass tube which latter serves to turn the rotor. The illustration above shows all the necessary details for the construction of this useful addition to any radio set.
—Herbert C. Leonard.

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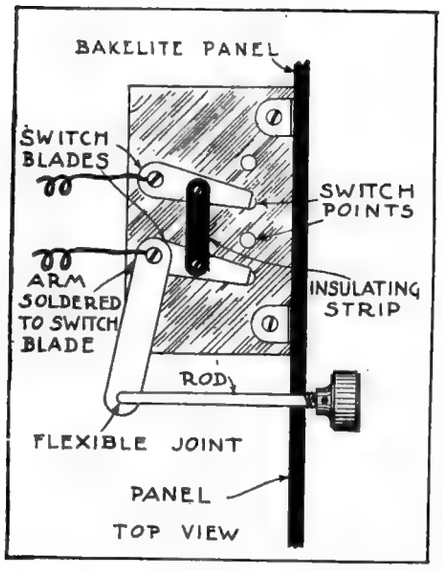
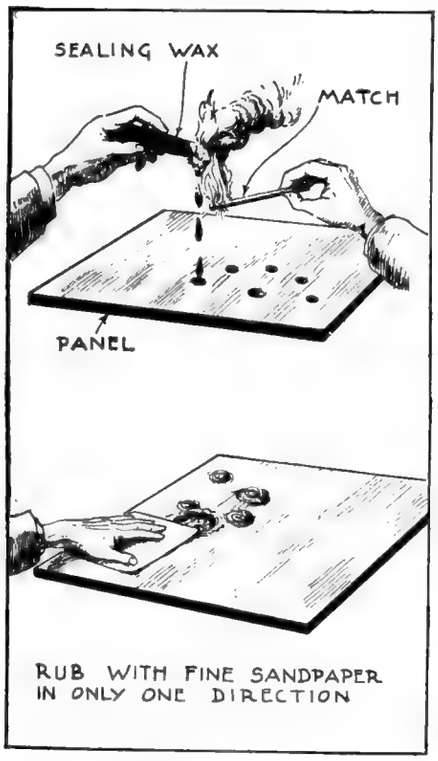
D. P. D. T. SWITCH



A simplified double-pole double-throw switch which can be operated from the front of the panel is shown above. The motion for changing the switch is very simple, it being only necessary to push or pull the knob. This switch could be used very readily in connection with the method of "Increasing Capacity," which was described in the Radio Wrinkle Column on page 945 of the January issue. The two switch blades and the arm are cut from stiff spring brass and the arm soldered to one of the blades. If possible, the arm and one of the blades should be cut from the same piece of material, as a stronger joint will result. A hole is then drilled in the other end of the arm and a piece of brass rod bent to fit therein. This rod extends through the panel and has a knob fastened to the other end.

—T. L. Stalker.

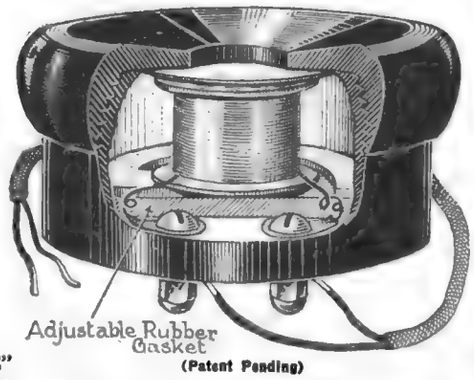
REPAIRING PANELS



Very often it is desired to use a panel for a certain instrument which has holes drilled in it which cannot be used. If left in this condition, the appearance of the instrument will be spoiled. Therefore, a piece of sealing wax is obtained of the same color as the panel and heated. The drops are allowed to fall into the holes on the panel, which is placed on a smooth surface. The panel can then be finished off with a piece of fine sandpaper, rubbing only in one direction. If the process is gone through correctly, a neat job will result. —Bud Mulkeyn.

Announcing the "GEMPHONE"

the DOLLAR 1000 ohm *ADJUSTABLE* PHONE



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Don't judge the "GEMPHONE" by its price. It is the cheapest radio phone on the market but its exclusive features place it in a class by itself. Its performance, the clarity and volume of sound reproduction, the faithfulness with which it reproduces radio broadcasting and code, the exquisite quality of tone together with a remarkably loud and clear volume, make it the equal to, and in many cases the superior of, phones at three and four times its price.

The "GEMPHONE" is of standard type and made of the very best grade of materials throughout. It is adjustable—one set screw enables you to adjust the phone to secure perfect reception under any condition.

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The "GEMPHONE" is sold unassembled. The coil is wound to 1000 ohms—all you need to do is to place the parts into the case, tighten up the adjusting screw and connect the terminals and cord. Our instruction pamphlet shows how to assemble it in two minutes, using only a screw driver.

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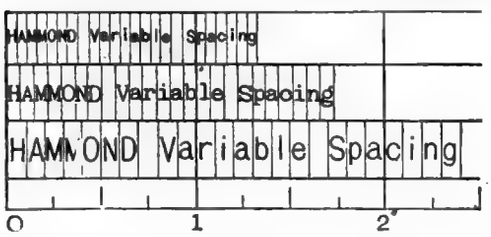
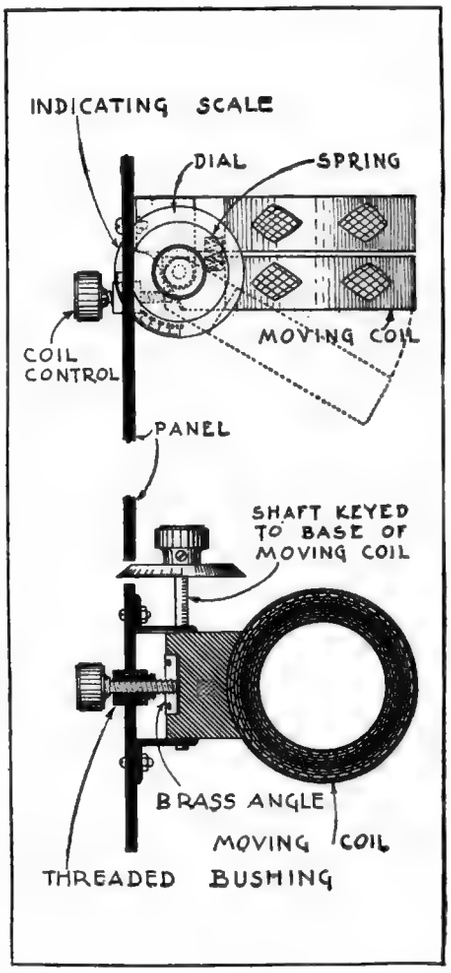


(18 Characters to Inch)
(14 Characters to Inch)
(10 Characters to Inch)

HONEYCOMB COIL CONTROL

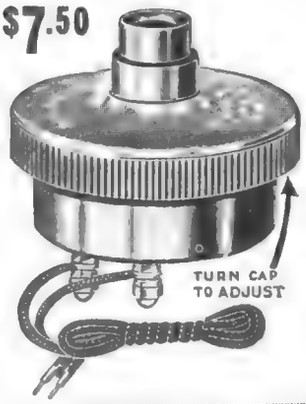


A well-made and accurate control for honeycomb coils which are mounted in back of the panel is illustrated above. An indicating dial is also arranged so as to show the position of the movable coil. The movable coil is mounted on a wooden block and a shaft, which passes through two brackets. The shaft is placed in position and fastened with a set screw. A brass angle is then screwed to the side of the block. The entire assembly is made as shown in the two illustrations above. Screwing the small knob in or out, varies the angle between the two coils. As the dial turns, a number is visible outside the panel, indicating the position of the movable coil. —F. R. Thresh.

The "Rico" Grand Opera Loud Speaker Unit

Patented, December 25, 1923.

$7.50



You have read no doubt that *every* loud-speaker is positively the best manufactured. We could make similar claims—on paper—and perhaps go the other one better. Modesty, however, forbids. For that reason, we make this statement:

Get a "Rico" Grand Opera Loud-Speaker Unit. Compare it with ANY loud-speaker that you have ever heard. Merely consider that the money you have paid for the "Rico" Unit is on deposit. If after five days you find that the "Rico" Grand Opera Loud-Speaker Unit does not give you greater volume and greater clarity of sound and greater joy than any other loud-speaker unit, then our dealers or ourselves will be glad to refund the purchase price.

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No Metal Can Touch the Diaphragm

This is a feature not found in any loud-speaker except the "RICO" GRAND OPERA LOUD-SPEAKER UNIT. Diaphragm cannot rattle. Metallic, harsh sounds are entirely eliminated AND the "RICO" GRAND OPERA LOUD-SPEAKER UNIT *is fully adjustable.* For light or soft tones, simply turn the milled rim. With this arrangement you can get either tremendous volume or soft tones as desired.

Aluminum shell and cap highly nickel-plated and polished. Five-foot green cord furnished. No. 75 "RICO" GRAND OPERA LOUD-SPEAKER UNIT as described. Price, $7.50.

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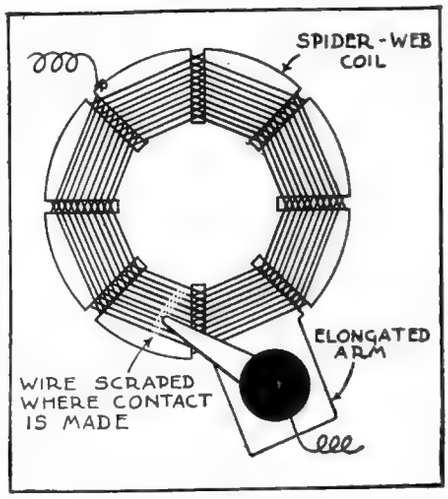
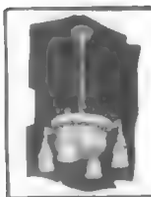
VARIABLE SPIDER-WEB COIL



A receiving set using spider-web coils is not always as flexible as might be desired. This can readily be remedied by mounting a switch arm on an elongated vane of the coil. The end of the arm makes contact with the wire in a path where the insulation is removed. One connection is made to the end of the coil and the other to the switch arm. The remaining end of the winding has no connection. —K. Andersen.



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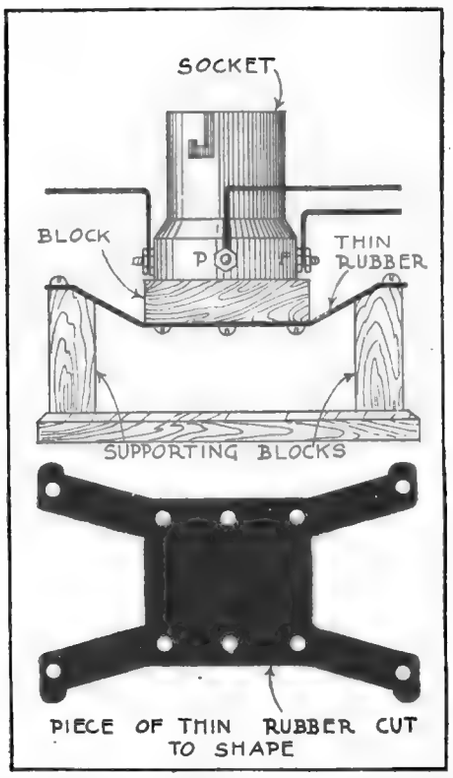
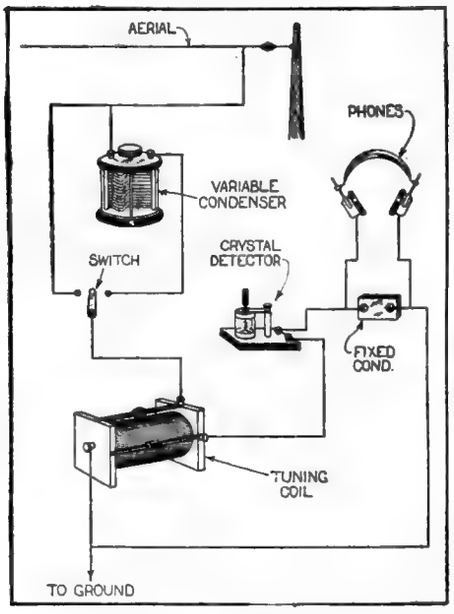
SOCKET MOUNTING



Particularly with the new types of vacuum tubes operating on one or three dry cells, the microphonic action is noticeable. This takes the form of loud noises and sounds similar to bells in the phones when the table or receiving set is tapped or jarred. Sometimes the sensitiveness of the tubes is so great that the vibrations caused by a person walking in the same room will cause annoying sounds in the phones. This can very often be eliminated, or, at least, reduced to a considerable extent, by mounting the socket in such a manner that the vibrations will be absorbed. Such a mounting is illustrated above. A piece of rubber of the correct size is cut from an old inner tube in the shape shown at the bottom of the above illustration. The four ends are then fastened to supporting blocks and the socket fastened to the center. If necessary, the socket may be supported by another wood block.

—John Rulison.

CONDENSER SWITCH



The switch in the above diagram was placed therein in order to simplify the tuning. If you are not sure that your crystal detector is in adjustment, throw the switch to the left, thereby cutting out the condenser. The tuning will be broadened and you may be able to hear several stations at once. Adjust the detector, throw the switch to the other point and vary the condenser until only the desired station is heard.

—Monroe Richie.

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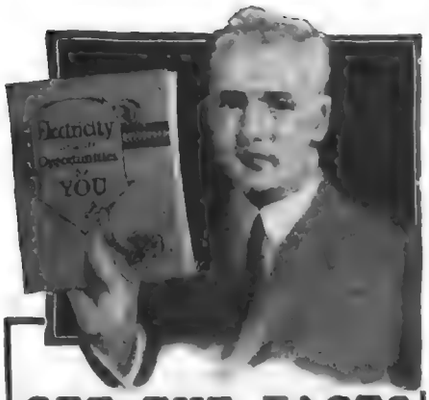

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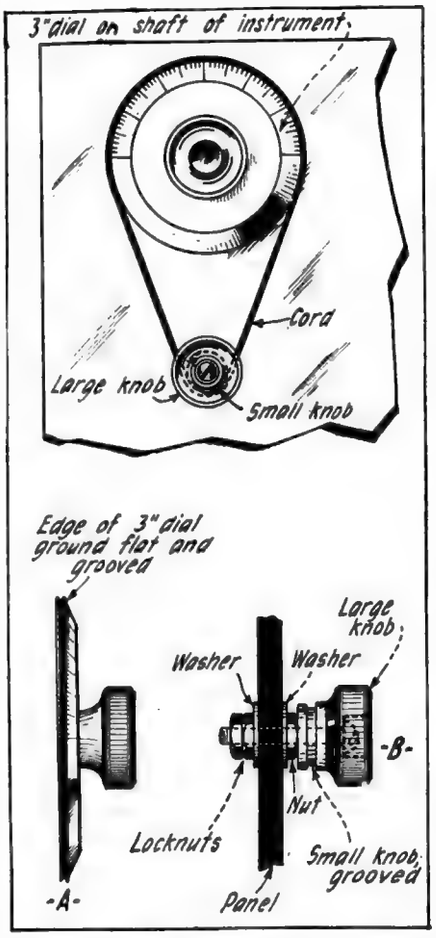
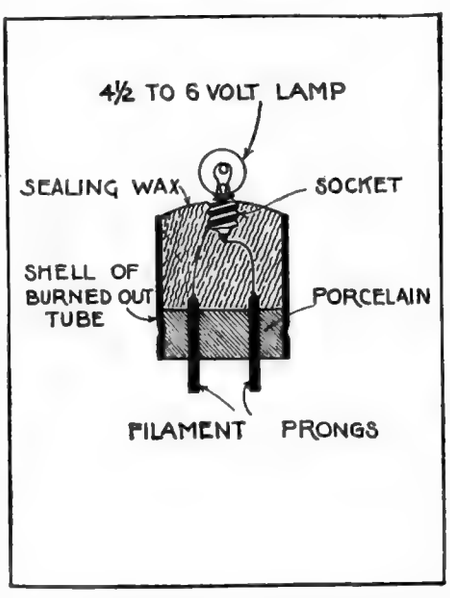
ANOTHER VERNIER



To make this simple and efficient vernier first remove the dial from the instrument and grind the edge flat. Then run a fairly deep groove all the way around the edge, as shown at A. Mount two knobs as shown at B, directly below the dial. Assemble the instrument on the panel and place the two knobs as shown above. Run a belt or cord around the two pulleys thus formed. The small knob will give a very fine variation. —W. D. Chandler.

SOCKET TESTER



A vacuum tube protector can be made by assembling a miniature socket in a standard vacuum tube socket as shown above. After you hook up a set, place the test lamp in the vacuum tube socket and turn on the rheostat. If the bulb lights, the filament circuit is all right. If the bulb does not light or burns out, there is a wrong connection. —L. W. Drear.

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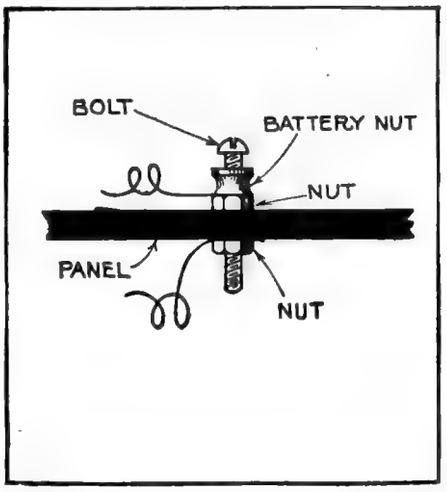
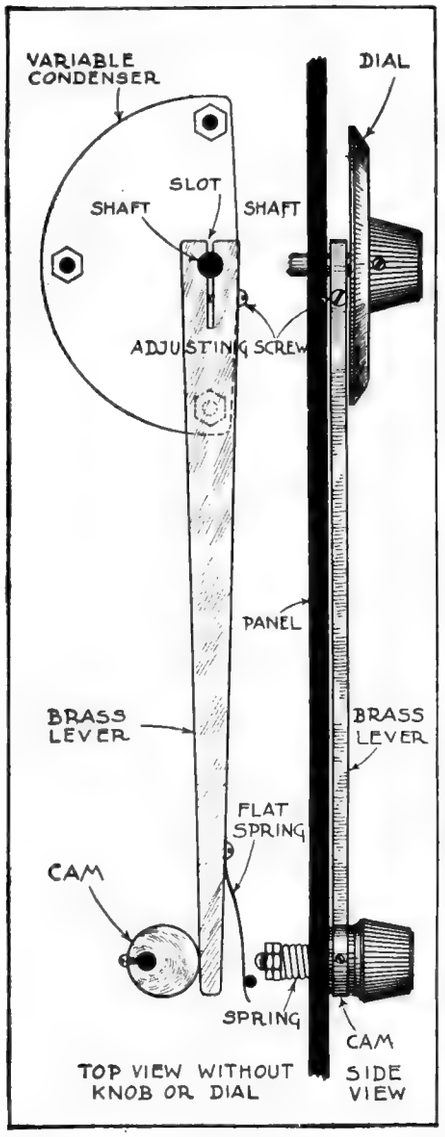
NOVEL BINDING POST



Many amateurs construct binding posts of battery nuts and bolts. From these same parts a post can be made as shown above, the nut of which cannot be lost.
—A. Gilbert Billin.

MICROMETER ADJUSTER



An extremely efficient vernier can be made by following the drawing shown above. An arm of fairly heavy brass is first obtained and slotted at one end. A hole is also provided for the shaft and an adjusting screw placed so that the friction on the shaft can be varied. A cam is arranged at the lower end so as to move the arm, and therefore the shaft, through a very small space. The friction on the shaft should not be so great as to prevent the turning of the shaft by means of the dial.
—Leo Chaviano.

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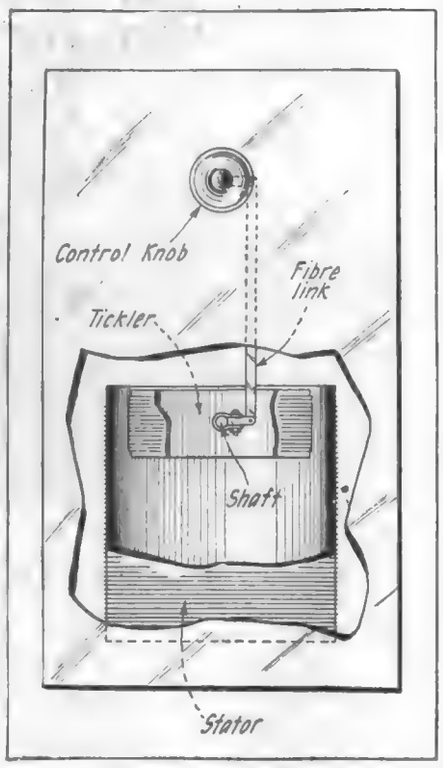


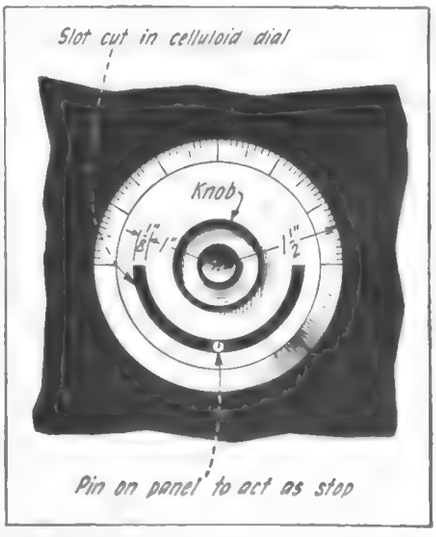
Very often it is desired to mount the rotor of a variocoupler so that the hand of the operator will not come near it when adjusting the instrument. This can very readily be accomplished by following the suggestion illustrated above. The rotor is mounted on a shaft and on the center of the shaft is placed a clamp with an extending arm. This arm is then connected by means of a fibre link to another clamp on the shaft situated some distance from the rotor. The extension arm on the latter shaft should be at the extreme end of it, so as to allow the knob to rotate through one-half of circle.

—Harry Ackerson.

Send On the Wrinkles

Come on fellows—and young ladies too for that matter—send in your Radio Wrinkles, but first let us caution you against one thing. That is, try to get away from the multitudinous verniers. It seems that in every mail, 90 per cent of the RADIO WRINKLE entries are some type of vernier.

DIAL STOP



When celluloid dials are used on radio instruments, it is a very simple matter to provide them with stops so that the rotating element of the instrument can only be turned to 180 degrees. First, cut a semi-circular slot in the dial as shown above, ⅛ inch [illegible]. A pin of any type whatsoever is then mount[illegible] panel in such a position that it will be[illegible] dial. When the dial is placed on [illegible]strument and fastened with the [illegible]ound that an efficient dial stop ar[illegible]

—[illegible] F. Gostin.

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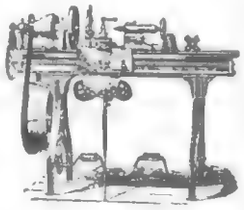

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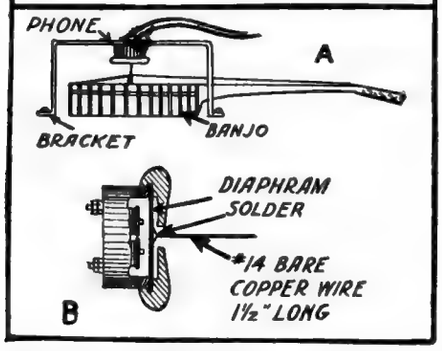
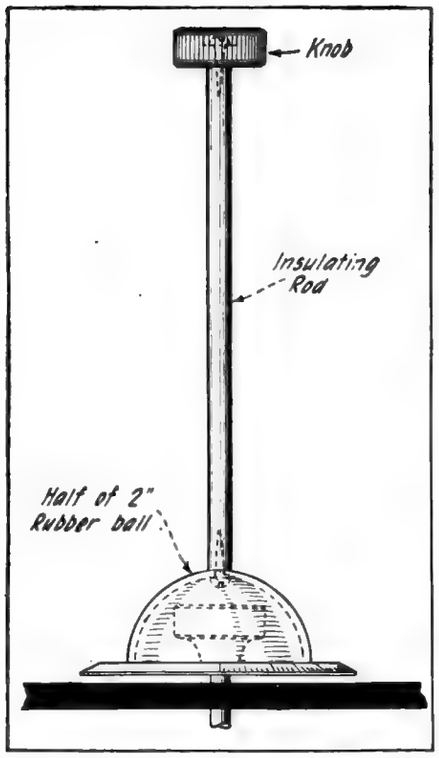


An excellent loud talker which does not make use of a horn of any type whatsoever can be made by pressing into service an old banjo whose head is intact, and some type of good phone. A piece of bare copper wire is soldered to the diaphragm of the receiver as shown at B in the illustration above. This may be done experimentally as shown in the photograph. Some sort of a bracket such as suggested at A in the drawing may be employed to hold the phone in position permanently. —Clyde J. Fitch.

ANTI-CAPACITY ROD



In tuning in C. W. stations or for very close work with almost any type of regenerative set, it is desirable to have some arrangement whereby the dials can be turned without having the usual body capacity effect. An excellent method of accomplishing this without defacing the set itself is illustrated above. A two-inch rubber ball is cut in half and mounted on a rod as shown. —Tom Tamen.

(*Continued on page* 1281)

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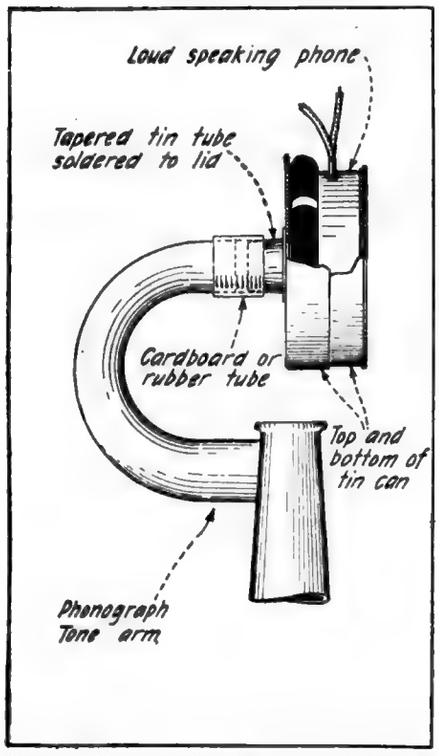
Radio Wrinkles

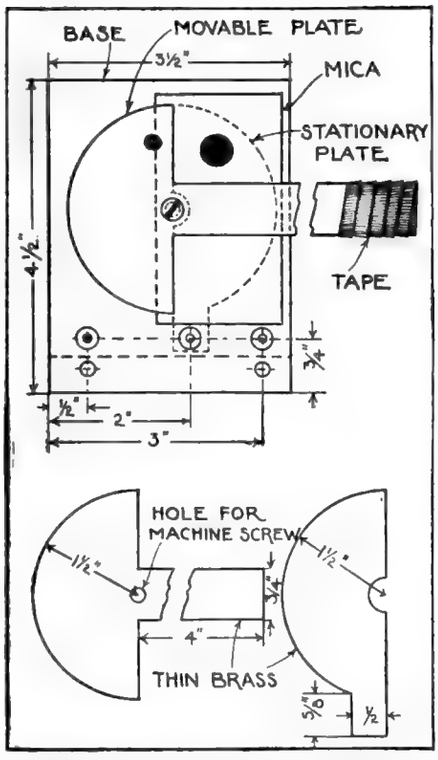
(*Continued from page 1279*)

PHONOGRAPH ATTACHMENT


Loud speaking phone
Tapered tin tube soldered to lid
Cardboard or rubber tube
Top and bottom of tin can
Phonograph Tone arm

The above illustrated phonograph attachment for using the horn of the phonograph, while very simple to build is quite efficient. First, cut the size and cut to the correct length the top and bottom of a tin can. Construct a slightly tapered tin tube and solder to the lid of the tin can having made a large hole directly under where the tube is soldered. Connect the tapered tin tube to the phonograph tone arm by means of a cardboard or rubber tube, from which the reproducer has been removed. —D. J. Oyer.

VARIABLE CONDENSER



A simple experimental variable condenser may be constructed as shown above. Cut one movable plate and one stationary plate as shown. Mount the latter on a base and cover with mica. Mount the stationary plate as shown and wind the end of the handle with tape for insulation. —Herbert T. White.

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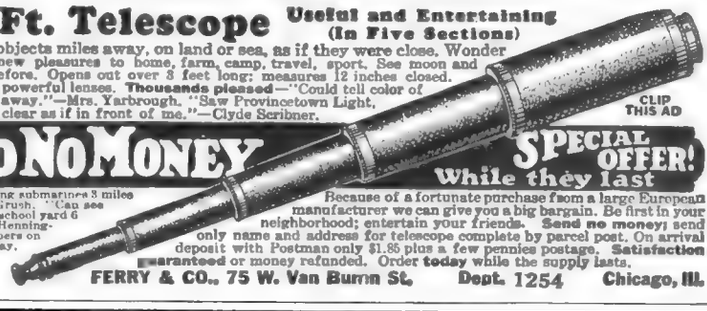

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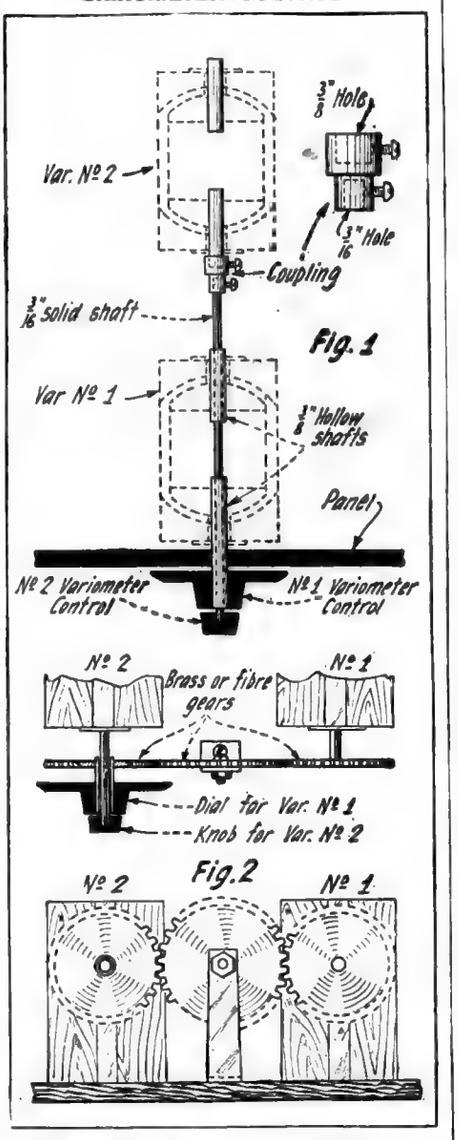
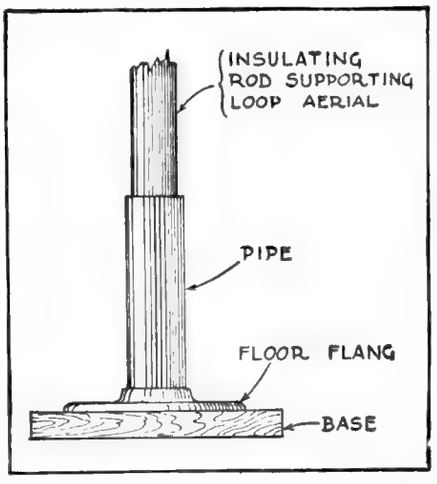


In the standard two variometer sets the controls for the two variometers take up quite a lot of space. Two methods are suggested above for conserving space. In Fig. 1 is shown the two variometers mounted directly back of each other with a double knob and dial for control. The same type of control is used in Fig. 2, wherein the variometers are placed side by side and the large knob geared to variometer No. 1. —Harry Ackerson.

LOOP AERIAL MOUNTING



An excellent stand for a loop aerial may be made from an 8 or 10 inch length of 1 or 1½ inch pipe screwed into a standard floor flange. The insulating rod supporting the loop aerial is to be placed in the pipe and can be rotated at will. —Charles Mallinckrodt.

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Dr. Hackensaw's Secrets

By CLEMENT FEZANDIE

(*Continued from page* 1205)

step into my airplane, and in less than half an hour we shall be at my Jersey farm, and there, in five minutes, you will get a better idea of my giants and dwarfs than you would from whole volumes of talk."

The menagerie was indeed an interesting place. Some thirty miles from New York City, Doctor Hackensaw had started a Brobdingnagian farm. Trees but a few years old were there, yet they towered higher than the gigantic California redwood trees. The grass of the pasturage was the height of ordinary corn. Giant animals and plants of many varieties were present, and there were numerous outlandish-looking species which the reporter did not recognize, they being enlargements of insects and of microscopic animalcules.

Here, too, was an aquarium with sardines as large as salmon, and salmon as large as small whales; while, on the other hand, a diminutive sperm whale was about the size of a minnow.

MICROBES

"What in the world are those?" asked Silas, pointing to a row of tanks in which certain nondescript species were floating in a peculiar liquid.

Doctor Hackensaw chuckled. "Those are my pets!" said he. "Those are giant bacteria and bacilli. I have here the disease-germs of cholera, malaria, yellow-fever and of many other illnesses. By growing them to this gigantic size, I can study them much better than I could through a microscope, and learn their life history and the effects of remedial agencies. Many a fact have I learned that will be of the greatest use in medicine, as well as in the arts; for you must know that microbes play a most important *rôle* in the industrial arts:—in fact, life itself would not be possible without them. I am gradually accumulating giant specimens of the most important species, and I confidently expect to revolutionize many branches of science by the knowledge I thus gain.

"Then too, since each part of the animal is increased in proper proportion, I am enabled to study the anatomy of the various organs, the red blood corpuscles and the phagocytes that attack the disease germs; the various tissues, the glands and their secretions; and the poisons and antitoxins and the serums I can likewise study the changes produced by disease—in short an entirely new world is opened up to scientific investigation."

"How about your dwarfs?"

"They are not so useful, and I have made comparatively few of them. That four-year-old baby giant you see over there, is looking at his twin brother—a four-year-old dwarf held in the palm of its nurse's hand. Yet both were grown from the same egg. Quite a contrast between the two, isn't there—the first child fifteen feet high and his twin brother about five inches in height! If I had made him a little smaller I could carry him around in my pocket and pass him through a keyhole whenever I wanted to know what was in a locked room. He would be an invaluable assistant for a gang of criminals. Behind him you will see a bull-moose, small enough to fit into a coffee-cup, but just as savage as if he were full size. See how he comes butting at my shoe!" And with the words, the doctor stooped down and picked up the frantic animal in his hand, and exhibited it, kicking and struggling, before he set it down again.

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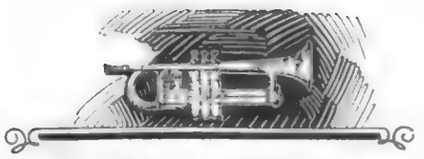

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A DREAM

"Last night, Silas," continued the doctor. "I had a most peculiar dream. I dreamt that I had succeeded in making a human midget, the size of a microbe. I had a hard job teaching him to speak, but managed it in this way. He spoke to me through a loud talker, while I answered him through a special instrument I invented to reduce sounds. Then I encased him in a microscopic submarine and injected him into the blood of a rabbit, with instructions to observe and report to me all that he saw on his trip. Of course, in his submarine, he could pass unharmed through the circulation and visit the different organs of the body in turn. I especially wished him to study the digestion and the action of disease germs and the anti-bodies. I followed his course by means of an X-ray apparatus, and after a week's trip I removed him from the rabbit's body and was gloating in anticipation over the wonderful account I was about to receive, when I was awakened by the yowling of a cat on the back fence! Wouldn't that jar you!"

* * * * *

The day following the one on which the above conversation took place, the New York Daily Growl appeared with the following glaring headlines:

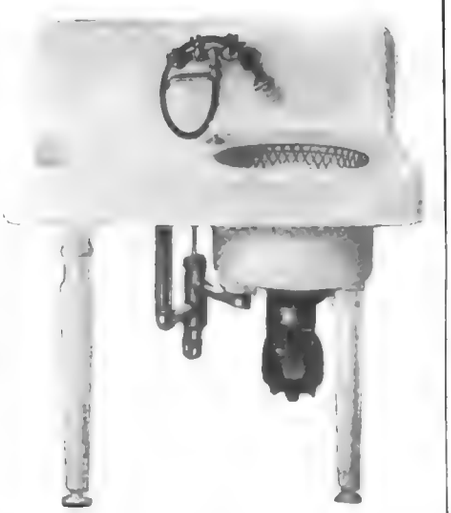
Menagerie of Giant Beasts Let Loose! Escape of Doctor Hackensaw's Gigantic Animals. Cow, the Size of a Brontosaurus Running Wild in Harlem!

The fact of the matter was that the giant cow had broken loose and had butted down the wall of the enclosure; and giant rabbits, chickens, dogs and what not, had made their escape and were terrifying women and children in the suburbs.

Men with shot-guns and pitch-forks chased the intruders, and the police, too, took a hand. But it was not till a regiment of soldiers organized a systematic hunt for the fugitives, that the last of the giant beasts was slain.

Doctor Hackensaw cheerfully paid all damages, but he was inconsolable at the loss of his cherished menagerie, the result of many years of patient work.

Centrifugal Dish Cleaner In Sink



By means of a centrifugal basket, operated by a motor and installed in a kitchen sink the daily grind of washing dishes is reduced to merely placing the soiled plates and cups in the wire basket and starting the motor. A spray throws water on the dishes during the entire washing process. —J. W. Von Stein, Reporter No. 126.

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The Man On the Meteor

PART IV

By RAY CUMMINGS

(*Continued from page* 1203)

III

The first of these incidents in Rax came when Boy was about two months old. A young virgin, the daughter of one of Caan's workers, disappeared. She was a girl somewhat younger than Nona. She was beautiful, in Marinoid fashion. To you, all these Marinoids must seem grotesque—unhuman perhaps. But beauty is not universally standardized—only locally. We admire our own kind. Your natives of Zanzibar think their own black-skinned, thick-lipped belles the most beautiful on Earth. And as I have said once before, *in the Marinoid world* the Marinoid women were the standard of beauty. Nona, so different, was the exception, the abnormality.

This girl who disappeared had been with one of Caan's scattered parties working on the sea-bottom, gathering shell-food. She had wandered away from the others, and when the time came to return to Rax, she was missing. We thought she might have become ill and gone home.

But she was not at home—nor could she be found anywhere in the city. Even this did not arouse much interest, except to her own immediate family. It was thought that some young Marinoid man had taken her for mate. According to custom the couple might readily have disappeared for a time—gone out together to live in the forest to escape work until their first period of love was past.

But there seemed no young man unaccounted for—and the girl did not return. Even so, the incident would have been forgotten, but soon another young girl disappeared.

There were perhaps thirty who vanished during that year. They were not all from the workers outside the city. We had long since ceased to take women with us; and those who lived in the forests and the mud-banks came crowding into Rax—and to the other cities nearby.

We knew very soon, of course, that our Marinoid women were being stolen. And there was one crowning incident that at last made us understand.

It was at what you would call midnight, when the city was asleep. Caan and I, on a belated errand, were swimming down one of the vertical streets. The place was deserted; the street was empty; the lights at intervals on the side walls of the houses illumined the water with a green, diffused glow—like lights in a thick fog at night on your Earth. The windows along the street for the most part stood open. Everywhere was heavy silence, with only the swish of the water as Caan and I swam through it.

A green figure in the horizontal street below us attracted our attention. It seemed to be a man swathed in a green cloak of seaweed. He saw us coming, and darting up to the street light which hung nearby, he flung something over it.

The light was obliterated; shadows fell over everything.

THE KIDNAPPERS

Caan and I were startled; we hung poised, just above the cross-street so that we could see along it in both directions. There were lights at distant corners. We heard a low but penetrating cry from near at hand. A signal! Other figures in the distance darted up through the water and put out the lights. The entire street was in darkness.

Caan and I whirled downward, shouting. Through the window of a house, we saw the stiffened body of a woman come floating.

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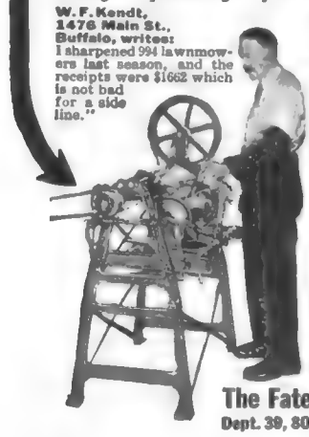

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There was light enough for us to see her white face and arms—a woman unconscious, shocked into insensibility as we later learned, by a bolt of animal electricity from her abductor.

Her body floated from the window as though pushed from behind. In the darkness, green-swathed forms seized it—forms which were barely discernible as blurs in the dark water—seized it and began rapidly towing it away.

Caan and I were after them. Our cries were arousing the city. Voices—confused questions—came from within the houses. Figures appeared; the street behind us was in a turmoil.

The woman's body with its almost invisible assailants was moving forward rapidly. Lines of white as the highly aerated water was stirred, radiated out V-shaped from its rapid progress.

But Caan and I, unburdened, could swim the faster. We overtook the invaders. There was a struggle in the darkness. A bolt of electricity went through me, but I recovered from it. Caan was shouting in hot anger as he struck at the green shapes that were attacking him.

The water all about us was lashed into white. It caught and reflected the light from a suddenly illumined window near at hand. I found myself gripping Og!

"You!"

But my voice seemed to inspire him to frenzied effort. He jerked away from me—was gone into the shadows.

Caan was now shouting triumphantly. He had dispersed his adversaries. The woman's white body—neglected—had sunk to the floor of the street. We swam down to her, chafed her arms and neck until at last she recovered consciousness.

The street was relighted. The houses were emptying themselves of their frightened inmates. A crowd gathered around us with confused startled questioning.

But Og and all his cohorts had escaped.

An hour later, when I returned home, Boy was lying in the hollow white shell which was his cradle, crying lustily. And Nona—my Nona—was gone!

IV

The hours that followed were a confused horror and despair to me. Yet there seemed no one but myself and Caan who considered this disaster more vital than those which had preceded it. At last we knew that the young women of Rax were being stolen—from under our very eyes—from the heart of the city, in the silence of the Time of Sleep. We knew now also, that they were being taken into the dread Water of Wild Things. Og's presence proved that. Og had gone to live with the fabled humans, half-savage, that legend said lived with the monsters of that strange dark region. And now Og had come back—and had been caught in the very act of an abduction. It was all clear now. And all we had to do was to guard our women—to watch carefully the entrance to the Water of Wild Things, that nothing, human or savage, could come out of it to trespass on the Marinoid domain.

RESCUE PLANNED

Thus ran the sentiment of the city; and the King, making a speech from the parapet of his palace roof-top, assured us in flowing phrases that the danger now was past. No marauders could come from the Water of Wild Things now that we were on the alert to stop them. He, our Monarch, assured us of that. Our women in future, were secure.

Had Nona been safe at my side, no doubt I should have applauded these sentiments as did most of the other onlookers. But Nona was *not* at my side. She was gone—into that horrible unknown region from whence none returned. The King said Marinoid women now were safe! What was that to me, with my Nona gone?

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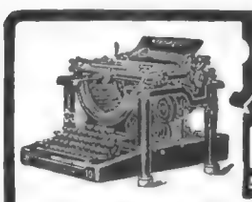

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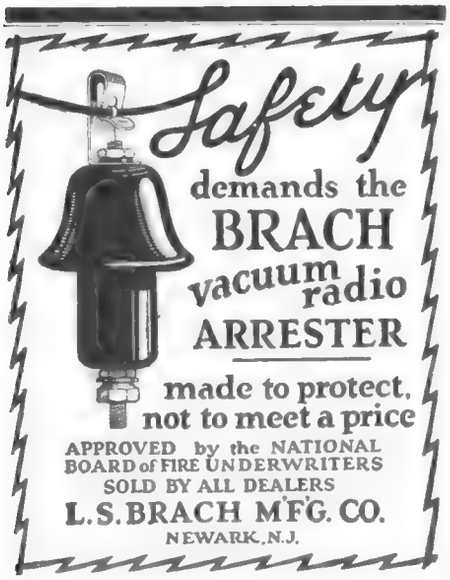

There was talk of an expedition into the Water of Wild Things. But none would volunteer, save those comparatively few who already had lost wives or daughters. Caan stood by me. He would go. And I—there would have been no sleep or food for me again had I tried to stay in Rax and yield up Nona to her fate.

There were no artificial weapons available in Rax save of one type—that slim hunting spear made of fish-bone—the spear with which the King's attendant had struck me down when first I was being brought to Rax. These spears were all the Prince and I had had for our hunting expeditions.

Other weapons? The Marinoids had had them in times gone by. But once—a lifetime before—civil war had broken out between two of the Marinoid cities; and when it was over all weapons save the simple spear, were abolished. There seemed no need of weapons. There was practically no wild life in Marinoid waters. The monster that had once come to devour them was a fable out of the distant past. And so they lived on in a false security—that security of disarmament which is so fatuous—making themselves defenceless so that they would not be tempted to fight; and forgetting that their very defencelessness must prove an irresistible temptation for some enemy to attack them!

We organized our meager, pitiful little rescue party. Led by Caan and me—with Caan's wife to care for Boy while we were gone—there was no more than fifty of us in total. Then, quite without warning, Prince Atar signified his intention of joining us—commanding us in person.

Can you guess the joy it brought to my heart? Our Prince, disregarding even the commands of his father, was coming with us!

Atar—for so I called him now in the intimacy which had come between us—was younger than myself. A slim, clear-featured youth, with a boyish smile, but eyes which had in them the look of one born to command. And Caan—a man past the zenith of his life, whose arms were no longer limber with youth but with a body strong and sturdy nevertheless. With these two to help me I felt that I could conquer whatever strange creatures we might encounter—and get my Nona back.

Our party was no more than together, when Atar announced we were making a mistake. There were fifty of us, practically unarmed. We were too large a party to go anywhere in secret; we would, by our very numbers be but provoking an attack.

THE PRINCE'S PLAN

Atar's plan, in brief, was that he, Caan and myself, should slip quietly into the Water of Wild Things and see what conditions were there. Then, perhaps without ever having been seen or forcing an encounter, we could return and plan an expedition in greater force—a force sufficiently great to insure success.

To me, whose one and only desire was to follow Nona and get her back, the Prince's words seemed rational indeed. What did I care for the safety of those other Marinoid girls who had been stolen?

The Prince, nevertheless, was right from every angle, and so it was decided that we three should go alone.

I shall never forget the scene as the Prince parted from his mother on the rooftop of the Palace. We were going to what everyone considered almost certain death. We would go, and they would never see or hear from us again.

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These Marinoids, crowding every corner of the cube of open water before the King's palace, hovered in silence as we prepared to leave. And the silence deepened as the Queen stood before her son, and he knelt at her feet.

"Goodbye, Atar," she said; and her glance included Caan and me. "We will wait and hope—for you to come back."

Her arm brushed his sleek head as he rose and turned away. We departed; and her brave, inscrutable smile followed us, as between those silent, solemn ranks of spectators we slowly swam along the streets and out of the city.

And presently, with tumultuously beating hearts, we three with only our slender spears, were approaching that dread black opening which marked the entrance to the Water of Wild Things.

V

We entered the opening, swimming in a group with Atar leading. It was already new territory for us. Our hunting expeditions had never taken us even as far as this; we were always content to remain in Marinoid waters. As we advanced, the rocky ceiling overhead was closing down on us, until soon there was no more than twice the length of our bodies between it and the floor.

On both sides the dark water stretched out as far as we could see into blackness also. We were descending now at an angle of perhaps forty-five degrees.

We had gone what you would call a mile possibly, when we came suddenly to a tangle of coral—a barrier that reached from floor to ceiling. I call it coral. It might have been a petrified vegetation. An all but impenetrable thicket—white like the frosted underbrush of your Northern winter forests—it seemed to bar our further progress.

We stopped; consulted, and swam to the left and right. But the tangle extended in both directions to the edges of the mile-wide passageway.

"It is this," said Atar, "which keeps our own region free of monsters. They cannot easily pass a barrier like this." He was smiling at Caan and me. "To this, perhaps, we owe our safety."

Caan was poking at the thicket, and we found after a moment that we could with difficulty force our way through it.

The realization that Atar's words brought us was at once reassuring and alarming. If no creatures of the wild could pass this barrier, what then might lie on its other side?

Caan, older and more poised than either Atar or me, was wasting no time on such thoughts.

"Come," he said. "Here we can get through."

The white underbrush must have extended for several hundred feet back and downward. We forced our bodies through it, seeking small orifices, bending aside the twigs, or breaking them off for they were very brittle.

We were an hour or more getting through. A few small bottle-shaped fish with protruding, ball-like eyes on the sides of the head, lurked here and there. They watched us curiously—unafraid, almost resentful it seemed, with their sidelong glances and their hasteless movements to avoid us. But we paid them little heed, for such as they often wandered into Marinoid waters and were easily killed with our spears.

The tangle of white underbrush gave way at last into open water. Again we saw the ceiling and floor close together—the same narrow slit sloping sharply downward.

With the white underbrush gone, the water seemed darker—so dark that we could hardly see each other a few lengths away. It was warmer too—unpleasantly warm; and to our nostrils came the taint of that stench now unmistakable.

ON SEARCH

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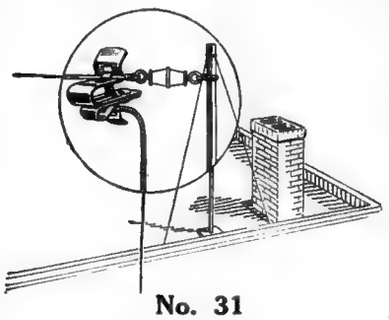

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what seemed an interminable time when abruptly the floor beneath us dropped away into a perpendicular cliff. Simultaneously the ceiling had heightened—disappeared into the watery shadows. We found ourselves poised with a vast void of ink before us. It might have been illimitable for all we could see of its boundaries. And empty! There was nothing but blackness—but it was that pregnant blackness that seems, not empty but merely to conceal.

"We must go down," said Atar. I could hear that he was trying to keep his voice steady. "They would live—down on the sea-bottom."

We descended along the side of the perpendicular cliff. A thousand feet? Three thousand? I cannot say. The water grew steadily warmer until its heat began seriously to oppress us. The thought came to me suddenly that we were well into the bowels of my meteor; its internal fires, now very close perhaps, were heating the water. My meteor! How remote the outside world—the outer surface—the Heavens—Saturn—the stars and the vast, unfathomable distances of the Stellar Universe—seemed to me now! *I* had been born out there somewhere. It was the first time in ages that such a memory had crossed my mind.

"Look!" cried Caan softly.

We huddled together against that black cliff-face. Below us in the void, a glowing point of light was moving. It seemed miles away; but it was no more than twenty or thirty feet, for as it approached we saw it was a long, sinuous thing with an illuminated head—a head that glowed phosphorescent, luridly green.

We held our breaths. The thing went past us—quietly, without seeming to notice us. It was a ribbon-like thing thirty feet long, two feet high, and no more than a few inches thick. A pallid white ribbon of puffy slime, frayed and tattered at its edges, it undulated gruesomely from end to end. In a moment it was gone, into that void of ink from whence it had come.

Again we descended. Other creatures passed us—headless things of black with illuminated parasites clinging to them; great fishes, star-shaped, with a brilliant green head in the center and each point of the star as long as our bodies; fishes, or were they animals? that were all head, it seemed.

We took heart, for none seemed to notice us. But there was a balloon of white jelly. It floated past us quite close. It was larger than any one of us. It seemed harmless and Atar swam beside it. Then suddenly the thing expanded, lost all its form and like a cloud of white mist, enveloped him. He screamed and we rushed to his rescue.

In an instant we were all three plunged into a confused, frantic horror for which I can find no words. Like thick white glue that was sticky, yet slimy, this almost imponderable stuff *fought* with us! Fought, I say—for it was using an intelligence against us! We floundered, flailing the water with frantic arms and legs. A noisome stench from the gluey stuff sickened us; the feel of it made our flesh crawl and the gorge rise in our throats. It was uncannily flimsy stuff. We could tear it into shreds, fling it away; but always it came back, to weld itself together. There *was* an intelligence in it! Not a centralized power of thought, like a brain, but an instinct for battle that must have been inherent in every smallest fibre of it.

We escaped at last. How, I do not know. Perhaps the thing wearied of us. And as we struggled away exhausted, with its horrible gluey particles which we had breathed in choking our lungs—we saw it floating off, ragged but still balloon-like, its original shape almost unimpaired.

SEARCH CONTINUES

We reached at last the bottom of the void. It was not level, but tumbled as though some

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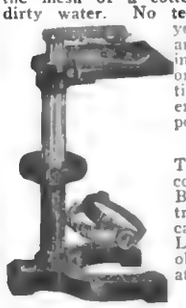

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cataclysm of nature had tossed it about. Banks of black ooze, a hundred feet high, were honeycombed with holes; valleys were beside them—valleys bristling with stalactites of black and white coral which stood up like pointed spears to impale the unwary trespasser. And there were miniature volcanic-looking peaks—cone-shaped. From one of them a stream of water almost hot, was issuing.

Frequently now, we saw lights; and all of them were the naturally lighted heads and bodies of swimming creatures. They moved about lazily, confidently, ignoring us; and we knew that when they were hungry they would feed, either upon others smaller of their kind—or upon us.

Over this tumbled, broken sea-bottom—where occasionally a giant crab or something of the kind would scuttle from a shadow into one of the deeper shadowed holes—we swam at an altitude of about fifty feet. We carried no light; and our bodies were shrouded in green-black cloaks. We still held our spears—poor, useless, futile things! Yet, as Atar said, they might not be useless against humans. And it was the humans, with their greater intelligence, that we now feared most. Conditions of life here in the Water of Wild Things, now became plain to us. These wild creatures were for the most part inoffensive up to the point of satisfying their own need of food. They fed upon each other and thus reduced their number. The humans, in open battle with them, were doubtless helpless. But the humans had the intelligence to hide—to escape. And the creatures of the wild did not bother unduly to pursue them.

Does this seem illogical to you? I assure you, it is not. The conditions we found, here in the Water of Wild Things, in the bowels of that meteor flying amid the Rings of Saturn, were almost identical with those which prevailed in the early periods of your own Earth's history. There is not, and never has been, a wild creature as predatory, as ferocious as Man himself. Your lion and tiger are cowards unless spurred by fright or hunger. The wild animals of your Earth would have been glad to live at peace with Mankind. It has been Man himself who consistently has been the aggressor.

"See there!" cried Caan softly. "Is that perhaps a place where humans live?"

Below us, in the distance ahead, were a number of tiny pin-points of light. And even as Caan spoke, a human figure passed near us—a figure swimming swiftly downward with a fugitive, frightened speed. It seemed to hold a sort of lantern in one of its hands outstretched—a small, shrouded light to guide it through the darkness. It did not see us, and in a moment it had passed downward into the shadows. But the moving point of its light remained visible.

"Come!" urged Caan softly. "That will show us the way. Hurry!"

We swam downward, following the point of light.

VI

The light ahead of us winked like a will-o'-the-wisp as intervening branches of coral, the edge of a mud-bank, or perhaps the body of some living creature, momentarily blotted it out. We were close to the bottom now. Along here it was a rolling, but fairly even bank of ooze, with grotesque squat plants growing in it.

The light could not have been more than a few hundred feet in advance of us; in its glow we could sometimes see the outlines of the human figure carrying it. We did not dare speak aloud now; we swam with that speed and silence which only one who lives in the water can attain.

Presently the light dipped downward and vanished. We saw that this figure we were following had entered a black cave-mouth—

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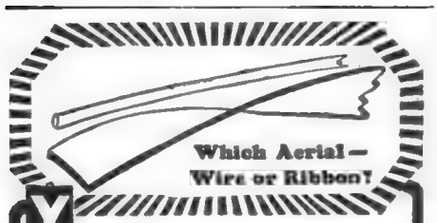

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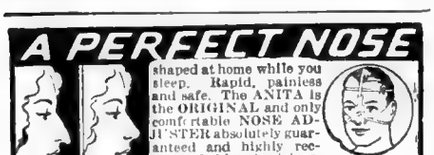

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an opening which ran diagonally down into a slimy bank of mud. And we saw, too, that the points of steady light which had first attracted our attention were the reflected glow of illumination from somewhere beneath the sea floor.

Silently we slipped into the cave-mouth. The moving light was down there; then abruptly it disappeared.

"Wait!" whispered Caan. "Go slower!"

We advanced, cautiously—and came again to a hedge of coral which impeded our passage. But this barrier we saw at once was artificial. It was the crude dorway—created by human intelligence and industry—which barred the creatures of the wild from entering. We threaded our way through it. Any one of those sea-monsters could have battered it down had he known his strength. But such a knowledge is given only to Man.

Beyond the barrier the dim glow of a diffused green light became visible. We edged cautiously forward, turned a corner, came suddenly to a ledge, and stopped—breathless, with wildly beating hearts.

We were looking down from near the ceiling of a cave. The water filling it was lighted with a pale green radiance, that lent a ghastly, wavering unreality to the scene. The cave might have been several hundred feet in width—nearly circular—and shallow, a hundred feet perhaps from floor to ceiling. The opposite wall to us was plainly visible. It was gouged out with niches in ranks and tiers—shallow ledges like the houses of your ancient, most primitive "Cliff-dwellers." We could see little family groups squatting on many of them—humans, not unlike the Marinoids in form—men, and women, and children.

But it was none of this that caused our hearts to leap so wildly. The floor of this community house was at the moment crowded with human figures. The figure we had followed in was swimming downward to join them. On a raised platform—a shelf of ooze at the side and bottom of the cave—several old men were sitting. They were not Marinoids—but they seemed to differ principally in the eyes, which were much larger and more vacant, and in the pallid, ghastly whiteness of the puffy flesh of their bodies.

On the same platform, stood Og! He was gazing down at the throng of people before him—haranguing them. His voice reached us—not Marinoid words, but enough like them—a corruption—to make them intelligible to us.

All this we saw at a brief glance. And the crowning thing: On the platform also, between Og and the white old men, my Nona was sitting with her arms bound at her sides! My Nona, beautiful as always, pink skin, blue eyes and golden hair—so vivid amid that pallid, ghastly throng! And she was unharmed—with spirit unbroken—I could see that by the flash of her eyes, her scornful, unwavering gaze as she leveled it at the puffy white faces staring up at her.

My Nona!

VII

Are you, my reader, wearied of me? Perhaps you are, and I am a proud old man who will force his words upon no one. You perhaps can anticipate what further adventures befell me in this dark and curious world. And what, after all, is their culmination to you! To me they are glorious memories of the deeds of my youth—and age lives upon its memories, as you know. To you, these memories of mine, mean—what? A chance to laugh—to ridicule?

I am too sensitive perhaps. Mayhap I do you an injustice. That some of you, indeed, ask me earnestly to tell you of my past, is gratifying, and I thank you for it. I will tell you more if you really wish it—tell you as best I may, the plain and simple truth of my queer and clouded life. Or, if you prefer, I will have done—lock it in my heart and live it over for myself alone.

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END PART IV.

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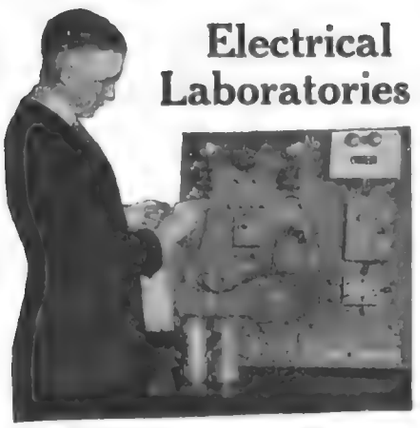

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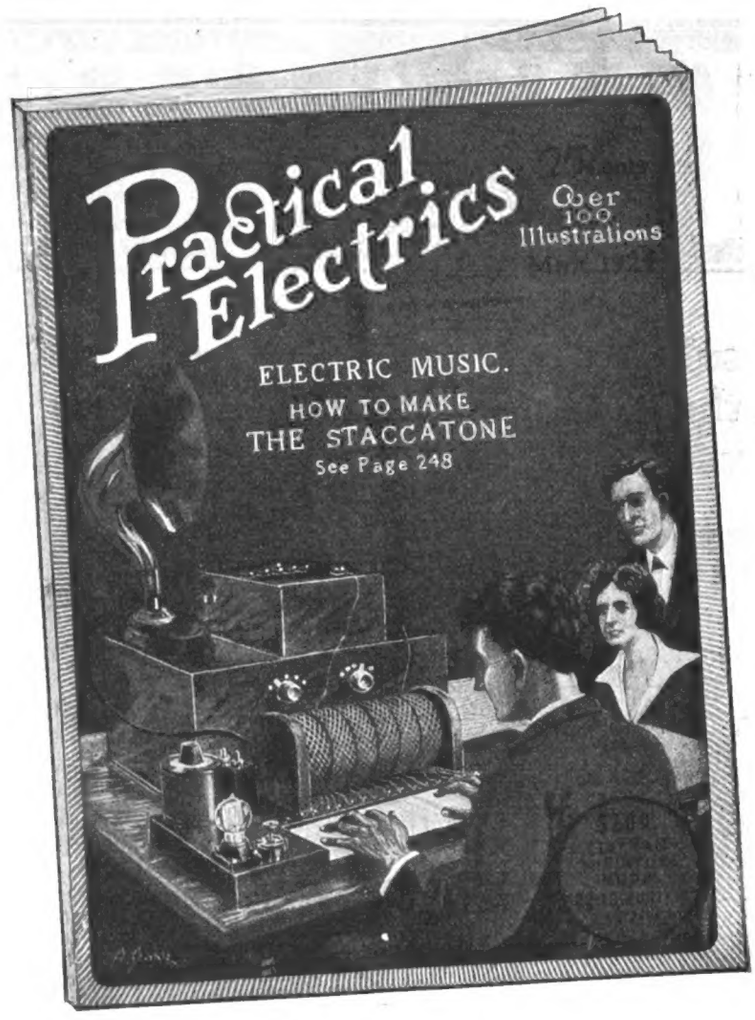

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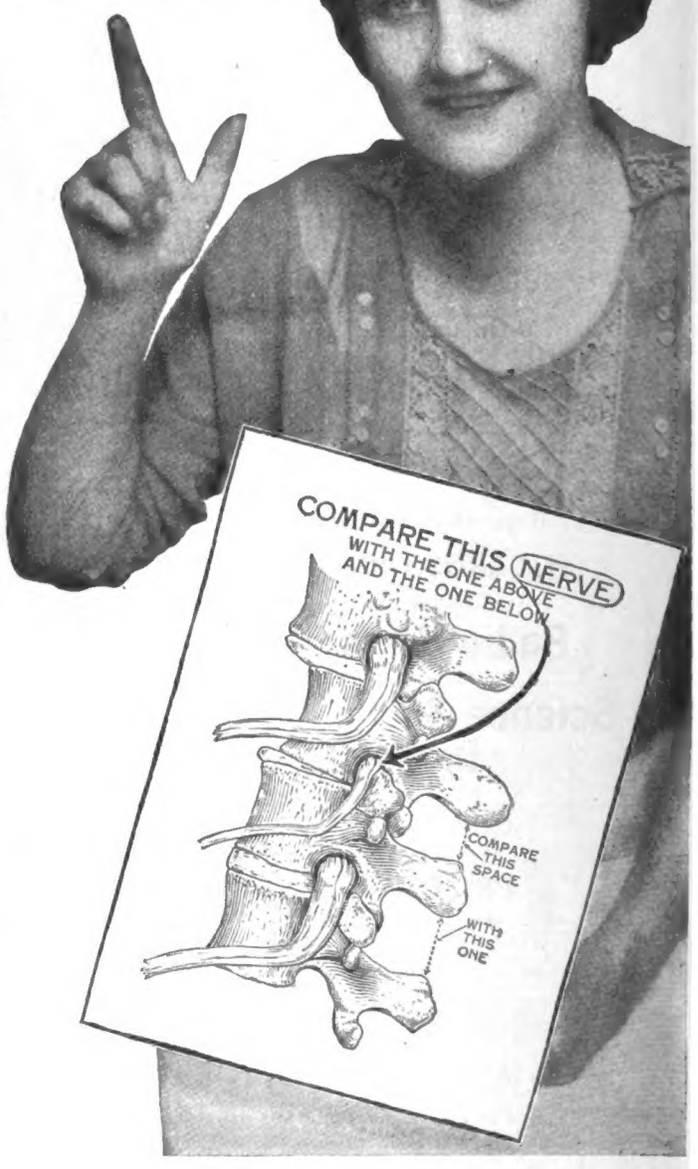

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